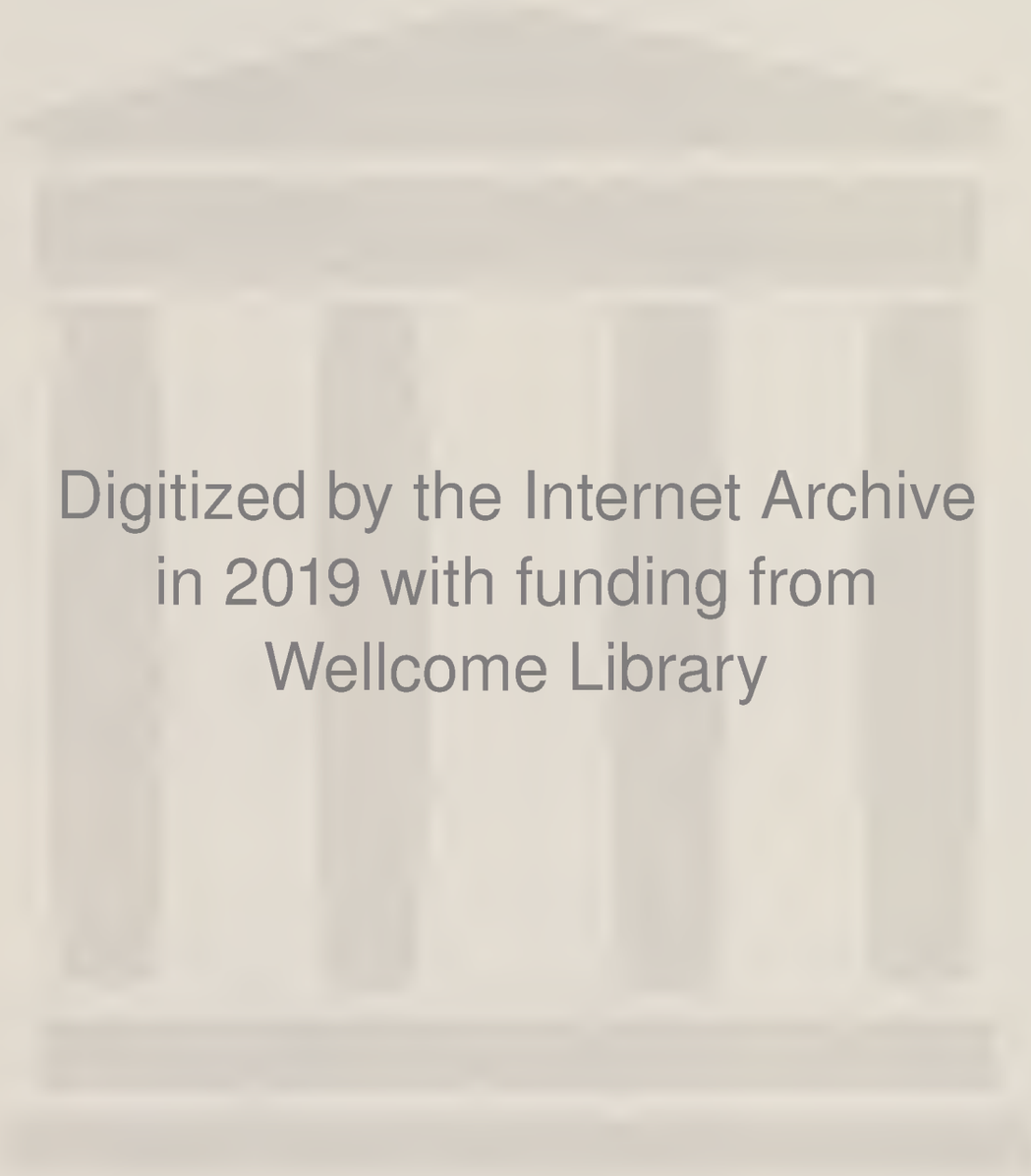
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THE CHEMIST;

OR,

REPORTER OF CHEMICAL DISCOVERIES AND IMPROVEMENTS,

AND

PROTECTOR OF THE RIGHTS OF THE CHEMIST AND CHEMICAL MANUFACTURER.

EDITED BY

CHARLES AND JOHN WATT.

VOL. V.

VOL II. NEW SERIES.

LONDON:

ALEXANDER WATT, 310, STRAND.

1844.

PEIRCE, PRINTER, 310, STRAND.

INTRODUCTION.

For the fifth time we take up our pen to address our readers on the completion of a volume, and to take a survey of the labors of a year. In doing so we cannot but feel that, while we hope that we have executed our task conscientiously—and to the best of our humble ability—our success has far exceeded our deserts and expectations. For five years—no unimportant period in the career of a science like chemistry—we have carefully recorded the principal labors of our most eminent continental brethren, thus rendering the English chemist conversant with every discovery of importance that has been made in every other part of the world.

We hope that, as old and tried servants of the public, little in the way of professions or pledges will be required of us, suffice it, therefore, to say, that we shall persevere in our straightforward, independent course, and shall seek for fresh opportunities of exerting ourselves on behalf of our readers generally in a scientific point of view, and of vigilantly watching over the interests of pharmaceutical chemists, with respect to their professional position. We intend, at the commencement of the ensuing Session of Parliament, to publish an article on the subject of Medical Reform, as affects chemists, and to urge upon that body and the Legislature, the necessity for immediate measures to relieve the former from the grievous disadvantages under which they labor. We shall also review the doings of the Pharmaceutical Society, and point out its tendencies.

We understand that our endeavors to induce the Society to lower its subscription, have prevailed so far that it is in contemplation to reduce it; but we have every reason to fear that that reduction will not be such as to satisfy our readers or ourselves. No confidence can be placed in the management of the Society after the erroneous course it has adopted for above three years.

Without dwelling longer on a subject which we intend to discuss at considerable length in our number for January, 1845, we will at once proceed, in accordance with the plan pursued in former introductions, to lay before our readers a summary of the contents of this volume of the greatest importance.

The Section of "Chemistry" is composed of some very important papers, translated from continental scientific periodicals; among the principal of which we may mention:—"Investigations concerning the Bile," by Professor Liebig; "Contributions to the History of the Iodides," by M. Labouré; Rochleder "On Legumin;" Professor Mulder "On the Products of the Oxidation of Protein in the Animal Organism;" "General Considerations and Inductions relative to the matter of Living Beings," by M. Chevreul; Professor Lepage "On some new Lactates;" Levol "On the Preparation of Pure Gold, with Remarks on the Assays of Gold;" "Investigations concerning the Metallic Acids," by M. E. Frémy; Gerhardt "On the Products of the Dry Distillation of the Sulpho-

cyanides;" Frémy "On the Action of Chlorine on Chromate of Potassa;" Favre "On the Carbonates of Copper;" E. F. Anthon "On the Means of Ascertaining the Adulteration of Potassa by Soda, and determining, in a simple manner, the Proportion of the latter;" "On the Laws which Govern the Electro-Chemical Decomposition of Bodies," by M. E. Becquerel;" "Report of the First Class of the Royal Institute of the Netherlands on the Nutritive Qualities of Gelatine;" "Critical Observations on the Phenomena of Respiration," by M. Gay-Lussac; "Investigations concerning Uranium," by M. Eugéne Péligot; M. Paul Thénard "On the Combinations of Phosphorus with Hydrogen;" "Preparation of Carbonate of Lithia;" M. P. F. G. Boullay "On the Production of a new Amide by the Action of Ammonia on Oil and Fat;" "On the Oxygenous Compounds of Gold, with Investigations concerning the Purple of Cassius and Fulminating Gold," by M. L. Figuier; Alexander Waechter "On the Chlorates;" The Baron de Reichenbach "On the Torrefaction of Organic Bodies;" MM. Favre and Maumené "On the Partial Reduction of Binoxide of Copper by Heat, and on the new Oxide which Results from it;" "Action of Ammonia on Butyric Ether," by M. G. Chancel;" Kopp "On the Decomposition of Hydriodic Ether by Heat;" Laurent "On a new Organic Alkali;" "On the Preparation of Sulpho-Hyposulphate of Potassa," by Mathieu Plessy; "Memoir on Butyrone," by M. G. Chancel; M. Millon, "Investigations concerning Iodine;" "On several New Salts, formed by the reaction of Sulphurous and Nitrous Acids on Alkaline Bases," by E. Frémy; M. Jules Reiset "On the Combinations of Two New Alkaline Bases containing Platinum;" "On Succinic Acid, and its combinations," by Professor Fehling; J. U. Lerch "On the Volatile Acids of Butter;" M. L. Figuier "On a New Mode of Analysing Blood, and on the Chemical Constitution of the Blood Globules;" "Memoir on Alterations experienced by some Organic Alkalis, in contact with, and under the influence of, Oxygen in the nascent state," by M. Eugéne Marchand; Deville "On Creosote;" M. Bouchardat "On Alcoholic Ferments;" Professor Liebig "On Mellon and its combinations;" Dr. E. A. Plattner "On the Bile;" Dr. O. R. Kühn; "On some Natural Phosphates and Arseniates of Copper;" Dr. A. Vogel "On the Distribution of Mineral Substances in Individual Organs of Plants;" M. E. Frémy "On Osmium;" M. Eugéne Péligot "On a New Oxide of Chromium;" "Investigations concerning a new class of Salts," by M. E. Frémy; "Remarks on Iodic Acid," by C. Rammelsberg; T. Scheerer, "On Polykras and Malakon, two new Mineral Species;" Professor Liebig "On the Preparation of Sulpho-cyanide of Potassium;" "On some reactions of Bichloride of Mercury," by M. E. Millon; Dr. F. Sacc "On the preparation of Xanthogenate of Potassa, and on the Products of its Decomposition by Heat;" Professor Liebig "On the Origin of Albumen in plants;" Filhol "On the Action which Iodine exerts on certain Salts, and on the Products which result from it;" Schlossberger and Fresenius "On the supposed combination of Hydrogen with Iron, Bismuth, and Sulphuret of Arsenic." This

section also contains many interesting articles by authors of good standing, amongst whom may be named:—Kayser, Dumas and Cahours, Barreswill, Baudrimont, Persoz, Hubatker, Redtenbacher, Marchand, Wohler, Zwenger, Pedroni, Fromberg, Varrentrapp, Wurtz, Saint Eyre, Colin, and Scribe.

The principal English contributors to this section are Mr. Lewis Thompson, Mr. Reuben Phillips, Mr. A. J. Cooley, Mr. Oliver Byrne, and Dr. R. Hare, to each of whom we tender our thanks for their valuable papers.

In "Chemical Manufactures," the most important articles are the undermentioned:—"On the Operation of Excise Restrictions upon the Progress of Chemical Science, as applied to the Arts and Manufactures of this Country," by a gentleman practically convinced of the truth of his doctrines; "On the Manufacture of Gunpowder, &c.," by our talented friend Mr. Marsh, of the Royal Arsenal, Woolwich; Professor Liebig "On the Distribution or Appropriation of Lands;" "On the Modes of Ascertaining the Value of Articles of Commerce, and more especially of the Alkalies, Acids, Ore of Manganese, &c.," by Charles Watt, jun.; "On the various Methods of Alkalimetry," by Charles Watt, jun.; M. Pinaud "On the Discoloration, by means of Electricity, of Papers sensitive to Light, and a new Class of Electric Pictures or Electrographs;" W. Miles, Esq., M.P., "Experiments on Manures;" "Experiments on the Fertilization of Land by Ammoniacal Salts, Nitrates, and other compounds," by M. F. Kuhlmann;" Schatteumann "On some Experiments relative to the Employment of Liquid Manure and Ammoniacal Salts for Fertilizing various Cultures;" W. H. Fox Talbot, "Improvements in Photography;" "Employment of Iodide of Potassium in Chlorimetry," by J. L. Lassaigné; "On the various methods of Acidimetry," by Charles Watt, jun.; "On the Coloration of Metals," by M. Becquerel; Professor Döbereiner "On Potato Oil and Purification of Brandy;" "Experiments on the Fattening of Geese," by M. J. Persoz; M. Daguerre "On a New Method of Preparing the Plates destined to receive Photographic Images;" M. J. Lassaigné's "New Investigations concerning the composition of the Mud of the River Nile;" Dr. C. Ettling's "Chemical Investigations concerning a Mine of Manganese found near Giessen;" "On the Composition of Fats, and the Theory of its Conversion into Soap," the most important article of the year, and one to which, we hope, great attention will be paid, as, if its views be correct, of which we have little doubt, our present notions of the chemistry of fatty bodies will be totally subverted. "On the Precipitation of Metals by other Metals," by M. Becquerel; MM. Gasparin and Payen, "Experiments on the Nutritive Quality of the Cakes of Sessamum Seed;" M. Dumas "On the Manufacture of Sugar;" "On the Extraction of Beetroot Sugar," by M. Payen; MM. F. C. Calvert and E. Ferrand "On Vegetation, considered in a Chemical Point of View;" "Experiments on the Nourishment of Cows with Beetroot and Potatoes," by M. Boussingault; "On the Explosion of Coal Mines;"

"Analysis of Dung Manure," by M. H. Braconnot; Mr. E. Thompson "On a simple Hydrometer; Xanthic Oxide discovered in Guano," with numerous articles by J. A. Phillips, F. Pellatt, J. Mitchell, Dr. Boettger, C. Watt, jun., Professor Faraday, A. A. Crole, A. Murray, Boussingault, and Pring.

In the department of "Pharmacy, Materia Medica, Therapeutics, &c.," we have given many articles of value, which we have not time or space to enumerate; among them may be mentioned numerous important cases of poisoning. "A new mode of preparing Fluid Magnesia," by Mr. George Raistrick; "Illustrations of Our Pharmacopœia," by G. Mowbray; "On the Influence of Flowers on Health," by W. H. Kittoe, M.D.; "Adulteration of Lac Sulphuris," by Lewis Thompson, M.R.C.S.; "On Liquor Opii Sedatious," by Mr. A. J. Cooley; Mr. John Badcock "On Vaccination, and on the Reproduction of Vaccine Matter direct from the Cow;" "Gamboge and Chimaphila in Dropsical Affections," by Dr. Kittoe; "Lectures on the Tests for Arsenic," by M. Rosenthal, M.D.; "On the Syrup of Iodide of Iron," by W. Onion; "On the Coloration of various kinds of Fecula by the Vapor of Iodine," by M. Gobley; "On the Opium of Algiers," by MM. de Mirbel, Boussingault, and Payen; Dr. Kittoe "On Marrubium;" "A Lecture on the State of Pharmacy in England, and its Importance to the Public, with Remarks on the Pharmaceutical Society," by J. Lloyd Bullock, which deserves a careful and attentive perusal; M. Burin "On the Preparation of Medicinal Extracts;" Mr. J. A. Cooley "On Pix Abictina Vel Burgundica—True and Factitious;" "Analysis of the Liver Oil of different species of the genus Gadus," by M. de Jongh; Mitscherlich "On the Action of certain Essential Oils on the Animal Economy;" "History, Analysis, and Preservation of Ergot of Rye," by Victor Legrip; Mr. A. J. Cooley "On Sagapenum and Elemi;" Dr. Houlton "On the Hyosciamus Niger;" Dr. Christison "On Poisoning by Sulphate of Iron;" "On the Comparative Medicinal Effects of the Salts of Iron," by R. H. Powell, M.B.; Dr. J. S. Campbell "On the Loss of Alkalis in Consumption;" "On the Extract of Henbane;" "The New Medical Reform Bill;" Duville "On the Iodide of Potassium;" "The Medicine Chest," by Sir George Lefevre; M. Mialhe "On the Different Kinds of Calcined Magnesia employed in Medicine;" Dr. Henderson "On the Employment and Action of Digitalis in certain Diseases in the Heart;" O. Schneider "On a New Mode of Preparing Aromatic Distilled Waters, in order to insure their Preservation;" with many others by Dr. Hanmann, Dr. Laner, Knapp, Dr. Frick, Dr. Pitschaft, Laroze, Forzembas, Mialhe, Darcy, Rossignon, Tauvel, Lebert, Stanelli, Dr. J. B. Thompson, Ruspini, Bich, Jacob, Dr. Perry, Garnier, Soubeiran, Cozzi, Simonet, Bronot, Flandin, and Danger, Putegnat, Dr. Hoffman, Dr. Volperling, Dr. Tott, Righini, Hondbine, Baumann, W. Smith, Gottschalk, Guldberg, Rigg, and Mignot.

In conclusion, we have merely to state that we shall continue to exert our best endeavors on behalf of our readers, to whom we sincerely wish a "Merry Christmas."

THE CHEMIST.

ADVERTISEMENT.

The circumstances under which the Fifth Volume of The Chemist is commenced are peculiarly auspicious; we find ourselves surrounded by the friends who have so kindly assisted us with valuable contributions during the last four years, and who have promised to continue their support: we see their numbers increasing from month to month, and from year to year.

Moreover, new and valuable sources of information are continually opening to us; and we are highly gratified to observe, on the part of the public at large, an increased and increasing attention to, and confidence in, the advantages to be derived from the study of chemical science.

Our editorial labors—performed in the midst of numerous professional engagements, and frequently in the hours usually allotted to repose—have been rendered lighter by the conviction that we are effecting good—that we are placing the discoveries of the most enlightened chemists in the world within the reach of the most humble—and by the warm expressions of approval from our readers, and of sanction and encouragement from the press of Great Britain (*with an isolated and despised exception*) and America; we therefore commence the New Year with zeal warmed by the reception this Journal has met with at the hands of the public, and with a determination to deserve the good opinion which it has been our unusual good fortune to obtain.

After an intimate acquaintance of four years, we hope that little in the shape of promises is required of us; however, for the satisfaction of those who may look for new pledges from us, we may state that it is our intention to strictly fulfil the objects for which The Chemist was established, viz:—to record all important discoveries and improvements in Chemistry, Chemical Manufactures, Agricultural Chemistry, and Pharmacy; to give all papers unmutilated, and all investigations and processes in detail, so that our readers may be enabled to repeat them without difficulty; to do all in our power to advance in scientific knowledge those for whom this work is especially adapted—the Manufacturers, Agriculturists, and Pharmaceuticalists of Great Britain and those who follow chemistry as a profession, and cultivate its application to the arts, agriculture, and pharmacy—by publishing everything of importance connected with these subjects.

It is scarcely necessary for us here to enumerate the advantages which must arise to every nation, nay, to every individual by whom chemical science is cultivated. Let any observing man walk through the establishment of the manufacturer who is piloted by this science, and that of him who scarcely

knows it even by name; let him view the farm of the scientific agriculturist in comparison with that of the *mere practical machine;* if he do not mark an astonishing difference, his observation will be very different from ours. There must ever be a well-developed line of demarcation between the man who regards merely the pounds, shillings, and pence part of his results, and him who resorts, for advantage over his competitors, not to art and trickery, but to the legitimate exercise of the talents which the ALMIGHTY has bestowed on him, in the study of Nature's beautiful and perfect laws.

It is not many years since, when in the pursuit of our profession as Chemists, travelling in some of the manufacturing districts, circumstances brought us into communication with many manufacturers, and conversation frequently turned upon chemistry, and we are sorry to say that many of them regarded this science as something to be avoided, and looked upon a chemist as little better than a juggler. We were then led to search into the cause of such a state of things, and found that it was induced by a set of ignorant impostors, travelling about the country with the view of selling processes to manufacturers, who, from want of knowledge, were exposed to fraud and imposition, to an alarming extent. But, in this respect, great improvement is daily being made; and the worthy manufacturers of the generation now passing away are having their sons instructed in chemistry, as affording the best means of competing with others, and of protecting themselves from the machinations of the fraudulent.

THE CHEMIST may be said to be edited in the laboratory; not by men who perform an analysis once or twice in their lives, but by chemists extensively engaged in the application of chemistry to the arts, agriculture, and medicine, and who perform many hundred analyses in every year.

We call the attention of our readers to the articles in our present Number, relating to the effects of the Excise Laws on the application of Chemistry to the Arts,—written by a gentleman in the highest degree qualified for the important task,—and to the great benefits which would be conferred on certain branches of manufacture by a legal enactment allowing alcohol to be used, free of duty, for manufacturing purposes,—by one of the editors of this periodical, who has had ample opportunities of obtaining information bearing practically on the subject he has taken in hand. There is also an important article on the Manufacture of Gunpowder and Colored Fires, by our respected friend, Mr. Marsh, of the Royal Arsenal, the celebrated inventor of the apparatus for the detection of arsenic, who has promised us some more papers.

It is our intention shortly to enter upon the subject of the Pharmaceutical Society and its doings; we shall abate nothing of our energy in the good cause of seven-eighths of the drug trade.

Several scientific gentlemen have promised us their aid; and although we have found promises of contributions more often broken than fulfilled, we have every reason to rely on those to whom we here allude.

The greatest possible care will, as heretofore, be bestowed on the selection of the articles, and every endeavor will be made to render THE CHEMIST more than ever deserving of the success which has attended its career. May our future efforts be as effectual as the past!

I. CHEMISTRY.

SOME REMARKS ON NITROGEN, OCCASIONED BY THE PUBLICATION OF A PAPER ENTITLED: "ON THE TRUE CONSTITUTION OF NITROGEN," IN NOS. XLVII. AND XLVIII. OF THE CHEMIST.

BY ARNOLD JAMES COOLEY.

ALTHOUGH considerable doubt exists as to the real nature of nitrogen, yet no facts have been elicited, even by the most careful experiments, that would justify us in omitting it from the list of chemical elements. Among the various arguments that have been adduced to show the probability of its being a compound body may be mentioned—

I. Its slight tendency to combination;

II. Its presence in the organs of animals, *said* to feed on non-nitrogenous substances;

III. The phenomena attending the formation of the ammoniacal amalgam;

IV. The production of ammonia or cyanogen from non-nitrogenous mixtures when specially treated (THE CHEMIST, No. XLVII.; Hollunder, &c.);

V. The *apparent* loss of a portion of ammonia, and the production of other elements in its place, in some *peculiar* and *inconclusive experiments* (Ann. Phil.); and,

VI. The white streak or deposit, the result of the electrolysis of moist air (THE CHEMIST, No. XLVIII.).

Passing over the 1st particular, which must be acknowledged as offering strong *hypothetical* evidence (?) of the compound nature of nitrogen, I will merely remark on the 2nd (that which must be familiar to every student in organic chemistry), that it is a mere assumption, utterly unsupported by the most exact experiments and researches performed by the most celebrated physiological chemists of the day (Dumas, Liebig, Boussingault, Magendie, &c., &c.). It has been amply proved that the quantity of food (grass) consumed by a cow in a day (as an instance) contains a superabundance of nitrogen above the wants of the animal; that no small portion is discharged with the excrements (Boussingault); and that articles of food wholly or nearly destitute of nitrogen (sugar, starch, fat, &c., &c.) are insufficient to maintain life (Magendie, &c.). To enlarge on this point is quite unnecessary, as any old lady who may be wilfully incredulous on the matter may easily remove her scepticism, by feeding her favorite lap-dog or pet tortoise on arrowroot, or some other non-nitrogenous substance, or mere element of respiration (Liebig).

III. The presumptive argument in favor of nitrogen being a compound of a metal united to oxygen, afforded by the phenomena attending the formation of the ammoniacal amalgam and the double hydruret of mercury and potassium, though warmly advocated by Davy and Berzelius, has unfortunately for its supporters but little weight, from the impossibility of procuring the hypothetical metal in a separate state, by the most refined chemical processes. The influence of the galvanic battery is no sooner withdrawn from the *one*, than its complete decomposition ensues, producing pure mercury, ammonia, and hydrogen, while the *other* is so slightly permanent that the least agitation is fatal to its existence. These hydrurets have been minutely studied by several eminent chemists (Davy, Berzelius, Gay-Lussac, Thènard, &c.), from whose researches it appears that to one part each by weight of ammonia and hydrogen, there is combined 1800 of mercury—a quantity so large as to render the opposition of a second metal extremely dubious, and quite unnecessary to account for their metallic appearance. "The examination of the ammoniacal amalgam affords no proof of the COMPOUND nature of nitrogen" (Liebig).

The apparent production of ammonia and cyanogen from some non-nitrogenous substances and mixtures, under peculiar treatment, has been known for some time, but the question as to the source of the nitrogen, admits of easy solution. M. Hollunder (some years ago) described the abundant production of ammonia from a mixture of liver of sulphur (crude sulphuret of potassium), and iron filings, strongly heated in a crucible, and sprinkled with water while still hot. There were present in the mixture, hydrogen, oxygen, sulphur, potassium, and probably a little carbon combined with the iron. Mr. Reuben Phillips has repeated this experiment under different forms, varying, however, the source of the alkali, from which it appears, that the iron and alkali (soda or potassa,) are essential to success. The latter gentleman, by an after-process, tests for the nitrogen under the form of a cyanide.

I have repeated these experiments under every form that suggested itself; the results coincided with those of Mr. Phillips, when I pursued *his* mode of operating, but when the *air* was *excluded*, the articles perfectly free

from nitrogen (as proved by previous testing), and *no* air from the lungs blown through the solution, which I made in a stoppered vessel with perfectly pure water, *no* nitrogen could be *detected* in *most* cases, and in the exceptions, only a *trace*, by the most delicate processes. The latter may be easily accounted for, when it is recollected that sand, powdered glass, pure sugar, &c., by merely being SLIGHTLY HANDLED, will yield ammonia and tinge turmeric paper, by Faraday's test ("Journal of Science," XIX. 17). The same may also be proved by the new and very delicate tests lately published. The detail of these experiments would be a mere repetition of what has only lately appeared in print. (See THE CHEMIST, No. XLVII. and XLVIII.)

Prompted by the opinions of Davy and Berzelius, concerning the compound nature of nitrogen, and the remarks of a celebrated Scotch chemist on the discovery of M. Hollunder, I was induced to pay considerable attention to this class of experiments, and from the apparent success which attended them, I feel convinced that any operator, unless he has recourse to the most rigid analyses, and exercises the utmost vigilance, may easily become *self-convinced* of the actual production of nitrogen from the materials employed. I procured it in numerous cases, from hydrocarbonaceous substances (sugar, starch, gum, &c.), many of the salts of the organic acids, and, in fact, in most cases where hydrocarbon was presented to the action of heat, with pure potassa or potassium.

On the publication of the production of ammonia from the combustion of sugar *(Microscopical Transactions)*, I repeated the experiment. I found that sugar (and other articles), burnt under a piece of glass moistened with hydrochloric acid (Reid's process), gave minute crystals of hydrochlorate of ammonia, easily visible by the use of a microscope of low power. The natural inference at the moment was, that nitrogen might be a compound of carbon and hydrogen, instead of an oxycarbon, as suggested by Mr. Phillips, or a metallic oxide, as hinted by Davy and Berzelius. Afterwards, however, I found that it was necessary to perform the experiment in the open air (or at least where its elements were present), to succeed, which at once satisfied me of the source of the nitrogen. I shortly afterwards found that Faraday had previously shewn the same to be the case, in his usual accurate, elegant, and decisive manner. The production of ferro-cyanide of potassium, by heating together the iron, alkali, and some cheap hydrocarbon, exposed to a current of atmospheric air, has now long been known and successfully employed in chemical manufacture (Prussian blue). The source of the nitrogen is here evident.

As an illustration of the difficulty attending researches on nitrogen, may be mentioned the error of a celebrated continental chemist (Reiset) who lately made an attack on the excellent mode of testing (Varrentrapp and Will's) by the formation of the double chloride of platinum and ammonium. The lecturer on chemistry at Charing Cross Hospital (Mr. Jones) read a paper before a late meeting of the Chemical Society (at which were present both Professors Brande and Graham), showing, that instead of 1·0 to 1·5 per cent. of nitrogen being yielded by this test from the analysis of sugar, he found from the average of three experiments only 0·06 per cent., a quantity attributable to impurity.

"Tartaric acid and charcoal made from white sugar gave similar results; the ammonia amounting to a mere trace, doubtless owing to foreign admixture. Hence it is inferred that the materials used by M. Reiset were impure," or that the process was conducted with insufficient care.

The objector to this process found that when the tube in which the substance was burnt was filled with hydrogen, instead of air, the production of ammonia was considerably lessened.

V. When dry lime and hydrochlorate of ammonia are heated together in a tube, connected with a Woolfe's apparatus, a portion of the ammonia has been said to be lost, or annihilated, while nothing to supply its place was obtained but water. "Of the tightness of the apparatus I am well assured. Indeed, I have performed the experiment with a continuous glass-tube, sealed and bent down at one end like a retort, while the other end was drawn out into a small tube, which passed under a jar on the mercurial pneumatic shelf. The sal ammoniac recovered, did not exceed three-fourths of that originally employed."—*Ann. Philosoph.*, Sept., 1817.

It appears singular that 26 years should have passed since the above announcement, without its having attracted that consideration among the learned which its importance (if clearly established) would deserve. I have carefully repeated the experiment several times, without perceiving any loss of nitrogen that might not be reasonably accounted for. The theoretical opinions that were current with combinations of ammonia, at the time the original experiment was made, may have biassed, in some measure, the calculation of the quantity of ammonia regenerated, as well as the mode followed to recover it, in the state in which it was first employed.

VI. I have often tried the experiments detailed by Mr. Phillips (see THE CHEMIST, No. XLVIII.), both with a battery and Leyden jar, with like results, when the air was moist, as it must naturally be when in contact with water or aqueous solutions, but have failed in every case when the air was rendered perfectly dry by passing over powdered chloride of calcium. I concluded that the trace of white matter produced was a salt of ammonia, probably a carbonate, or a mixture of carbonate and nitrate, formed by the mutual decomposition and re-union of the elements of water and the atmosphere, but from being unable to procure more than a trace, quite insufficient to test, this was necessarily mere supposition. My conjecture has since, however, been confirmed on a grand scale, by means of the most powerful electrical machine in the world (the hydro-electric), from which it appears, that electrical discharges made in damp air, decompose aqueous vapours, the hydrogen of which unites with a portion of the air to form ammonia and water, while the oxygen unites with another portion to form nitric acid; which two products of electrolyses combine at the instant of their separate formation, by mere chemical affinity. If Mr. Phillips will persevere, no doubt he will be able to satisfy himself that the white matter alluded to by him is nitrate of ammonia (nitrate of oxide of ammonium).

If nitrogen were isomeric with carbonic oxide, as suggested in No. XLVIII. of THE CHEMIST, how comes it that the most powerful deoxidising substances, under the most favorable circumstances, do not separate its oxygen? Sir H. Davy volatilised potassium, in an atmosphere of nitrogen, over mercury, and in this state, passed the voltaic flame of 2,000 double plates through the vapor without success. Other eminent chemists have also applied every method which ingenuity and the most improved state of analytical research can suggest, with like results. If, then, it has resisted the skill of a Davy, and the decomposing influence of the battery of the Royal Institution, assisted by the highly combustible metal, potassium, is it reasonable to suppose (unless clearly proved by experiment) that the common electrical machine (possessing, at least, but feeble power), or any other minor attempt, without being based on some principle or plan of research which has hitherto escaped the *savans* of science, will (even though it be a compound) disturb those powerful affinities which have so long bound its elements together? If it were so easily produced by crudely heating certain mixtures of carbon, metals, or alkalis, as has been asserted, why has its nature so long remained a mystery? Why does not analysis succeed as well (?) as synthesis? If it be isomeric with carbonic oxide, why is it not combustible? Why is its nature so perfectly opposed to every known combination of either the one element or the other? It is no easy problem in chemistry to *combine*, and, at the same time, to defy *resolution*.

The remarks of a celebrated foreign chemist (Liebig, "Familiar Letters," 55.) on the cases of isomerism, said, by Dr. Brown, of Edinburgh, to have been recently discovered (by himself), apply to many experimentalists and manufacturers of nitrogen. "He (Dr. B.) thought he had converted iron into rhodium, and carbon, or paracyanogen into silicon. His paper on the subject was published in the Transactions of the Royal Society of Edinburgh, and contained internal evidence, without a repetition of his experiments, that he was totally unacquainted with the principles of chemical analysis. But his experiments have been carefully repeated by qualified persons, and they have completely proved his ignorance; *his* rhodium is iron, and *his* silicon an impure, incombustible coal."

Without, however, wishing to reflect upon the exertions of any laborer in the field of science, it must certainly be acknowledged, from the experiments already published, that it is rather hasty to speak of nitrogen as a compound of oxygen and carbon, and still more premature and imprudent to enter into any theoretical speculations respecting the atmosphere ultimately becoming the great storehouse of fuel (carbon) for the world. Liebig has already shown the atmosphere to be a never-failing source of carbon as the food of plants, in its carbonic acid, but never dreamt of carbon in its nitrogen: would it not be a less Utopian scheme to deoxidize the atmospheric charcoal than to procure it from the nitrogen? The suggested source of the ferrocyanides (see THE CHEMIST, No. XLVII.), as I have before mentioned, has been long adopted with success.

Conclusion.—From a careful review of the various experiments on nitrogen, from the time of its discovery by Rutherford, of Edinburgh, in 1772, until the present day, there does not appear any reason to believe that it has been *decomposed* or can be *produced*, by any known process, from elements or substances, not already known to contain it. The strongest arguments in favor of its compound nature, are doubtless derived from its slight tendency to combination, the negative or rather neutral character which it appears to possess, and the ignorance which exists as to its uses in the economy of the world. These facts, supported by the

opinions of some of the most celebrated chemical philosophers, both of the present and past day, induce the hope that it will ultimately be proved to be *decomposable.*

ON THE CAPACITY OF SATURATION OF CHEMICAL BODIES GENERALLY.

BY S. E. PHILLIPS.

THE confusion resulting from the misapprehension of hydrogen in its electro-position and consequent reactions, is most flagrantly seen in the modern notions of that property which is vaguely denominated the "capacity of saturation." In part III., No. 1, of "Turner's Elements" (recent edition by Liebig and Gregory), sulphurous acid, SO^2, is supposed to combine with oxygen, chlorine, sulphur, and other substances, *without any change in its capacity of saturation!!!* and that we may not be supposed to have misunderstood the authors, it is further added, "*on this property, therefore, these, substances can have exercised no influence*" *!!!* Verily, this would seem too ridiculous for a moment's refutation!! the merest tyro in chemistry must be aware that the capacity of saturation of sulphurous acid, or "its capacity to neutralise a base," is greatly augmented by its union with oxygen as in sulphuric acid; it is true the said acid may be made to unite with KO and other bases, and thus portray itself as an *ide,* but its decomposition is instantly effected by sulphuric and other more definite acids, whose definiteness—taking the case of sulphuric acid—consists in this only, that its primary or tuic combining energy is further exhausted, or better reduced to the *idic** standard, while its idic energy is more negatively exalted by an additional O in its constitution. But there is not a greater difference between the simple or *inic* bodies SO and SO^2, than there is between SO^2 and SO^3. The intermediate binoxide, though sometimes found dedoubling with weak *idic* functions, is generally and most naturally *inic*, and uniting with simples; but sulphuric acid, SO^3 is definitely *idic*, always dedoubling with *ides*, and therefore its capacity of saturation and other properties and reactions are as widely different as its composition varies from that of SO^3.

But, perhaps, it will be replied, we have mistaken the authors referred to, and use the phrase in a different sense to that alluded to; we confess to have found it very difficult to understand the views of Liebig and Berzelius on what they term the "capacity of saturation," unless they mean to denote by it that capacity or power by which one body saturates or neutralises another, a definition, however, that would ill harmonise with the above remarks of Liebig. But let these eminent authors speak for themselves; and first, from Berzelius's great work, *Treatise on Chemistry*, I have, by the kindness of a friend, been favored with the following translation:—

"When acids form salts with salifiable bases, they always combine with a determinate quantity of base; and that quantity constantly depends on that of the oxygen contained in the base. Thus, for example, when sulphurous acid is saturated by many different bases, a given weight of acid combines with a quantity of these bases, which varies in each, but where the contained quantity of oxygen is the same for all. In order to express in a general manner the quantity of base which saturates an acid, we choose that quantity of oxygen which is found in the different bases by which 100 parts by weight of this acid are saturated, and we call this number the 'capacity of saturation' of the acid." Examples are then enumerated by which nitric acid is 14·75 and sulphuric acid, 19·96, &c., &c.

Now, granting for a moment that when a given weight of acid (sulphuric, for instance) is saturated with different bases, the contained quantity of oxygen in the different bases "is the same for all;" then on this basis follows a plan whereby "the capacity," &c., "may be expressed in a general manner."

In further illustration of this plan, and previous to an examination of its basis, I subjoin the following connected facts and inferences:—

1. 100 parts sulphuric acid, whose atomic weight is 40, must therefore contain about $2\frac{1}{2}$ equivalents of acids, and therefore neutralise $2\frac{1}{2}$ of base (as of KO, potassa), which contains 19·96 parts of oxygen, or about equivalents.

* The brevity of these remarks implies a previous exposition of this subject more at length; in reference to which we may briefly state that the terms *inic*, *idic*, and *saltic* refer to simple binary and quaternary bodies. The word simple being rejected in obedience to the advanced state of the science, since bodies are now known possessing the same kind of properties and reactions though of a compound nature—as cyanogen, ethule, methule, &c., &c. *Inic* is derived from the terminal of chlorine, bromine, iodine, &c., and applies to all bodies possessing kindred properties and reactions with such; two of these unite to form an *ide*, a term by no means confined to binary compounds, but comprehending all whose constitution and properties are analogous to oxides, as chlorides, sulphides, cyanides, &c.; two such bodies unite to form a salt.

Again, 100 parts of sulphurous acid, whose atomic weight is 32, must contain more than three equivalents of acid, and must therefore saturate more than three equivalents of base, as of KO, which contains about 26 parts of oxygen, or more than three equivalents.

In other words, 19 expresses in a general manner the capacity of saturation of sulphuric acid, and 26 that of sulphurous acid; therefore the WEAKER acid possesses the GREATEST capacity of saturation!!!!

II. 100 parts sulphuric acid, &c., &c. (See No. I.)

Again, 100 parts of columbic acid, whose atomic weight is 209, must contain about one-half an equivalent, and must therefore neutralise (according to the above, though not according to fact) about one-half an equivalent of base, which contains four parts, or one-half an equivalent of oxygen.

In other words, sulphuric acid is 19, while columbic acid is only 4; therefore the *weaker* acid possesses the *least* capacity of saturation!!!!

If it be deemed desirable to perplex by these *merely* numerical equations, is a question I leave others to decide; meanwhile I must reprobate the use of a term or phrase in reference to them, which naturally leads the mind to think of *chemical* associated with *numerical* relations!! But, according to the above, the "capacity," &c., is determined wholly and solely by the atomic weight of any compound, an element which probably does not in the least affect the phenomena in question. Is it not well known that the above acids have very different powers of saturation, and differences to which the above numbers make no approximation whatever?

Such difficulty and confusion would never have crept into the modern development of a science, whose simplicity is so vast as to amount almost to sublimity, were it not for the fact that this simplicity is as yet very little understood and appreciated; hence we find Professor Graham contending that the nomenclature of the science must not be constructed with reference to the popular comprehension of the many, but must be necessarily confined to the learned and initiated few!!!

This confusion will be more evident as we examine the foundation of this indefinite superstructure, "when acids form salts" as before. This is altogether untrue, but more particularly in two respects. 1st. If it is not true of the numerous salts having other than *protinic* bases, as the *bi* and *sesqui-ides*, &c., and these are by no means necessarily bisulphates and tersulphates in their most neutral forms, though, it must be admitted, from their high position in the *idic* series, and consequent approximation to the acids, that they are more disposed towards the *polyidic* than the *protidic* type of saltic constitutions.

The sulphate of alumina would give 60 instead of 19. I have, in another paper, more fully treated of the molecular laws affecting these more compound salts, as also of the *sesqui-ides* generally.

2nd. It is not true of the salts with *protinic* bases with two or three exceptions. If the capacity of saturation of the same acid for different bases were of the same kind or character, then might it be true of all the salts with *protinic* bases, as KO, NaO, KS, NaCl, &c., &c.; but what is the fact? Does sulphuric acid evince the same capacity of saturation when uniting with one equivalent of water HO as it does when neutralised with one equivalent of potassa KO; the latter being so energetically positive, while the former constitutes the oxhydric acid of the oxhydrates?!!!

The supposition is too trifling to be entertained for a moment! We know that in one case the saturating power is neutralised, and in the other it is not half saturated; hence, while the sulphate of potassa in its most neutral form is monobasic $KO + SO^3$, so also the most neutral form of the sulphate of water is *HO, HO, HO, HO, &c.*, $+ SO^3$, presenting a *saltic* type proportionally more *polyidic* than that of the soda and lime sulphates, in the same ratio that it is higher in the series and more negative than those basic oxides. The phraseology of Berzelius would seem destructive of his own hypothesis; for instance—"The quantity of base necessary to produce with 10_0 parts of sulphuric acid a *perfectly saturated* $_{or}$ *neutral compound*," &c.

The Berzelian law may be true in one or two cases of the sulphate class, but to the hundreds it can have no possible application; for ascending the idic series from the potassium and sodium oxides in proportion as the negative or acid oxide is approximated do $1\frac{1}{2}$, 2, $2\frac{1}{2}$ and more equivalents of base become necessary to the production of a "perfectly saturated or neutral compound."

Another proof of how little is understood of this subject is presented in Professor Graham's arrangement of mono, bi, and tribasic salts. That study of relative phenomena which involves definite lines of demarcation should always be suspected; in reference to the 1st division, the Professor adds, "The great proportion of acids, such as sulphuric, nitric, &c., &c., *neutralise but one atom of base*, and form therefore monobasic salts." It would be very easy to find

a tribasic salt of potassa where the acid and compound base would possess a capacity of saturation very similar to that of a tribasic sulphate of copper, or one of Graham's tribasic salts. Why should one be called monobasic and the other tribasic? Why should one have the benefit of the substitutional hypothesis and the other be denied it? The *same* laws of simplicity and universality alike govern the constitution and reactions of both and all dedoublements, and 2K can be replaced "without affecting the structure of the compound" in precisely the same manner as 2H, 2Cu, or any other basic *ines* to which the substitutional hypothesis would confine the privilege.

(This part of the subject is treated more fully in a paper devoted to the constitution of salts.)

In lieu of all this contradiction and complexity we substitute no new hypothesis, but simply attempt to prove the adequacy of established electro-chemical principles to explain all the phenomena of saturation with its kindred philosophy of types and substitutions.

I do not seek to express in a general way that which is inexpressible, since it varies in every possible case. The quantity of base which saturates 100 parts of any acid may be ascertained by the atomic weight; &c.; but what purpose is to be gained by this perplexing admixture of real with fancied numbers or relations I am at a loss to conceive.

The whole philosophy of saturation involves a law of the easiest expression, and the most universal range of application; it is not confined to a portion of salts, but fully embraces them all, whether of oxy, chloro, sulpho, or cyano-acids; nay, further, it extends with equal force and beauty throughout all bodies whatsoever of chemical constitution, whether of *inic*, *idic*, or *saltic* types.

I. That the most remote bodies in the series to which they belong unite with the greatest force, involving the most perfect saturation which is indicated by the simplest types.

II. That in proportion as bodies approximate in the series to which they belong so do they unite with less force, involving a more imperfect saturation, which is indicated by the most compound types, and as this proximity still further approaches identity of electro-position, so do the bodies lose all "capacity of saturation" whatever, uniting, not in ratios of 1 to 1, 1 to 2, 3, 4, 5, &c., &c., but mixing indefinitely in all proportions, without any change of general properties.

This oxygen may be traced from its *protinic* potassium oxide KO, or point of greatest saturation progressively up the *inic* series, through its bi, sesqui, ter, quatro, quinto and septinic functions to its point of greatest proximity and indefiniteness, where oxygen and chlorine may be often recognised in certain very *polyinic* bodies as mixing in different proportions, and each promiscuously performing its functions.

Thus a given *ide* may be traced from its monobasic salt of KO or KS, &c., &c., or point of most perfect saturation progressively up the *idic* series through its basic, bi, tri, and polybasic, or, more correctly speaking, through its bi, sesqui, ter, quinto, and polyidic functions to its point of greatest proximity where all power of saturation is lost, and the two bodies mix together as isomorphic compounds; not, however, because any force of union exists; but because, from their similar electro-position and properties, reagents act similarly on both, often involving some practical difficulty in their chemical separation.

For the more minute study of these two laws in the minutiæ of their details, and with reference to the theory of types and the law of substitutions, I must refer to their development elsewhere (see former paper).

The enunciation of a principle of great beauty and universality is all that concerns me here, and how far I have succeeded others must determine.

I commenced this article by reference to the suppositions involved in Liebig's remarks on the relative capacity of saturation of the sulphurous and sulphuric acids; to that author I now return.

The first chapter of the work referred to would seem modestly to promulgate the daring hypothesis of Dumas, that the reactions and other properties of bodies do not depend on their own essential nature, or their electro-position, so much as on the molecular place they occupy in a compound.

The refutation of these views I have attempted in another paper, and should my estimate therein prove correct, the recent attempts to "explain a certain class of phenomena by their aid" must fail completely; for when mineral acids unite with organic substances, they must necessarily manifest a change in their capacity of saturation, the bodies being changed, their properties must also be altered, though it is possible this change may be very small.

The phenomena of these compound acids are fully explained by those electro-principles of which this paper is, professedly, but a partial development.

(To be continued.)

INVESTIGATIONS CONCERNING THE BILE.*

BY PROFESSOR LIEBIG.

The liquor secreted in the gall-bladder of animals, and generally known under the name of bile, possesses a slightly alkaline reaction, and is of a rather thick and oily consistence; it is of a pure golden yellow, or greenish yellow color, which becomes deeper in the air; it mixes with water in all proportions, and then forms a liquid which froths like soap and water; it has a very bitter taste, with a sweetish and very tenacious after-taste. Bile, dried in the sand-bath, readily dissolves in alcohol, with a dirty, dark green color, appearing red by transmitted light, and then leaves a very nitrogenous substance, which swells into a jelly in water (the mucus of the gall-bladder). Bile may be obtained perfectly colorless by putting its alcoholic solution in digestion with animal charcoal; it is also possible, by cautiously adding to it baryta-water, to free it from the coloring matter which forms an insoluble compound with baryta (Berzelius); it contains cholesterine, which is easily removed from it by mixing its concentrated alcoholic solution,—decolored by animal charcoal,—with twice its bulk of ether; the bile, which is insoluble in ether, separates under the form of a thick syrup; the cholesterine remains in solution with the ether, and crystallises, by evaporation, in bracteæ as white as snow.

Bile, deprived of coloring matter, and freed from the fatty substance, by being several times treated with ether, furnishes, by desiccation, a solid mass, resembling gum-arabic, susceptible of being powdered, which readily redissolves, without residue, in water, and in anhydrous alcohol; if its aqueous solution be saturated by hydrate of potassa, it separates under the form of a thick syrup, of the consistence of turpentine. Acetic and oxalic acids produce no change in the aqueous solution; the addition of a mineral acid, on the contrary, immediately, or after prolonged contact, causes a milky turbidness, and a syrupy liquid is separated from it; part of the mineral acid is found combined with the soda. Acetate of lead and nitrate of silver precipitate the solution of bile purified by the above process. A solution of purified bile is *completely* precipitated by tribasic acetate of lead, and there remains, in solution, only a quantity of organic substance, corresponding to that of the compound of lead, which is slightly soluble. An excess of acetate of lead redissolves a portion of the precipitate (Enderlin, J. L.). Neutral acetate of lead forms no precipitate in an alcoholic solution of pure bile; the basic acetate produces, on the contrary, a plastic precipitate, which is dissolved by the addition of neutral acetate of lead.

An aqueous solution of bile is immediately precipitated by neutral acetate of lead, and the liquor then takes an acid reaction. A solution of bile, to which acetic acid has been added, is not precipitated by acetate of lead; the acid set at liberty, in the precipitation of bile by the neutral salt of lead, consequently prevents ulterior precipitation by the same salt. If the acid be exactly neutralised by an alkali, the neutral salt produces a new precipitate, and the liquor again becomes acid; the basic acetate of lead forms, for the same reason, a new precipitate in the solution of bile, which has already been precipitated by the neutral salt. When an aqueous solution of bile has been precipitated by neutral acetate of lead, and when basic acetate is afterwards added to it, a great part of the bile remains in solution in the excess of acetate of lead, and can no longer be precipitated by the salts of lead. The matter which remains in solution, with the employment of the neutral and basic acetate of lead, has been regarded as a peculiar substance, and has been described under the names of *biliary sugar* and *bilin*, by Gmelin and Berzelius, although it is nothing more than pure bile.

Impure bile does not leave carbonate of soda after its solution in alcohol; the alkaline reaction must not, therefore, be attributed to this salt. Dissolved in alcohol and dried *in vacuo*, over sulphuric acid, impure bile leaves, after calcination, a white or slightly yellowish residue, powerfully effervescing with the acids, chiefly formed of carbonate of soda; it contains, moreover, traces of iron (Enderlin), phosphate of soda (Thènard, Enderlin), and chloride of sodium. Moistened with sulphuric acid and calcined, this residue represents 16·5 per cent. of the weight of bile (Demarçay). Bile, freed from fatty substances and coloring matter (by baryta), gives, after calcination, 11·70 of ash, formed of 11·16 carbonate of soda (as well as sensible quantities of potassa (Enderlin), and 0·54 of chloride of sodium (Kemp). The composition of bile, freed from coloring matter and fatty acids, is:—

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* *Annalen der Chemie und Pharmacy.*—For two important memoirs on the bile, by Berzelius, see The Chemist, Vol. I., page 225, and Vol. IV. (Vol. I. New Series), page 247.

	Kemp.			Enderlin.	Theyer and Schlosser.		
Carbon	58·46	58·46	59·9	58·28	58·00	58·49	59·48
Hydrogen	8·30	8·81	8·9	9·20	8·09	8·48	8·47
Nitrogen	3·70	4·21					
Oxygen	22·64	25·76					
Soda	6·53	6·53					
Chloride of sodium	0·37	0·54					

After having deducted the fixed principles, we obtain, as the composition of the body combined with soda:—

Carbon	63·7
Hydrogen	8·9
Nitrogen	3·9
Oxygen	23·5

If it be admitted that the soda remains in the state of neutral carbonate, after combustion, 100 parts of pure bile contain 64·9 of carbon.

From the foregoing composition of bile, it results that it is a compound of soda with a nitrogenous body, which there is every reason to rank among the acids, since it possesses the property of neutralising soda. The smallest quantity of acetic acid is sufficient to dispel the feeble alkaline reaction which bile ordinarily possesses; in many cases its reaction is not alkaline. The following is the best process for obtaining the acid of the bile, which we designate under the name of *bilic acid*.

BILIC ACID.

Choleïc acid of Demarçay; *bilifellic acid* of Berzelius.

Preparation. — One part of effloresced oxalic acid is dissolved, with heat, in an alcoholic solution of eight parts of dried purified bile; the mixture is heated to ebullition and left to settle for ten or twelve hours. There is immediately separated, by the solution of the oxalic acid, a white pappy mass of oxalate of soda in fine crystals, whose quantity increases by cooling; as soon as no more crystals are deposited, the liquor is filtered, diluted with a little water, and put in digestion with carbonate of lead, until every indication of the presence of oxalic acid has disappeared; the lead is then removed by a little sulphuretted hydrogen, and it is then evaporated to dryness in the sand-bath. The same body is obtained by dissolving bile in anhydrous alcohol, and saturating the liquor (avoiding all elevation of temperature) with dry hydrochloric acid gas. All the soda of the bile may be considered completely separated, when no more crystalline precipitate is formed by the mixture with ether. After the separation of chloride of sodium, the greater part of the hydrochloric acid is driven off by evaporation in the sand-bath; a little water is added; two layers are then formed—an aqueous layer, rendered very acid by hydrochloric acid, and a soft, resinoïd deposit of bilic acid, which is insoluble in the dilute mineral acid. This deposit is dissolved in alcohol, and oxide of lead in fine powder is gradually added to the solution, until the liquor presents a slight quantity of lead, which is removed by sulphuretted hydrogen.

We may also (according to M. Demarçay) dissolve the alcoholic extract of bile in 100 parts of water, and evaporate the solution in the sand-bath, adding two parts of sulphuric acid, diluted with ten parts of water, until, at the end of a few hours, oily drops appear on the surface; it is then allowed to cool. Bilic acid is separated under the form of a viscid liquid, of the consistence of turpentine. The congealed mass, which floats on the surface, and which is a mixture of cholesterine and margaric and oleïc acids, is removed, and the evaporation of the acid aqueous liquid is continued; if, then, it be allowed to cool, fresh quantities of bilic acid are, from time to time, separated. We proceed in this manner, until the liquid is reduced to one-fourth of its original bulk; the acid separated is collected, washed with a little dilute sulphuric acid and freed from the acid which it retains, in the manner above pointed out.

According to Theyer and Schlosser, pure bile is precipitated by basic acetate of lead; the precipitate is heated, to ebullition, with water, and dilute sulphuric acid is gradually added until the precipitate has lost its plastic state. The liquor is then filtered, and the oxide of lead which remains in solution is separated by sulphuretted hydrogen.

To free bilic acid, prepared according to these different methods, from the fatty acids with which it is mixed, it is necessary to dissolve it in a very small quantity of alcohol, and to precipitate it by the addition of ether, which retains the fatty acids in solution. Dried in the sand-bath, or *in vacuo*, over sulphuric acid, bilic acid is (when it has been procured from bile deprived of coloring matter) colorless, or of a very light yellowish color, presenting the appearance of gum, easily reduced to powder of a resinoïd nature: its powder readily attracts humidity from the air, and agglutinates; it is very

bitter, very soluble in alcohol, and insoluble in ether; it very readily dissolves, in all proportions, in water. The solutions possess a powerfully acid reaction; the dilute aqueous solution remains, at the end of several days, clear and colorless; the addition of acetic acid does not precipitate it; a small quantity of dilute hydrochloric or sulphuric acid produces in it a milky turbidness, and the acid in solution is deposited on the sides of the vessel, in resinoïd flocks, or in transparent oleaginous drops. An excess of hydrochlorie and sulphuric acids immediately causes the turbidness to disappear: the precipitate which is formed in an aqueous solution of bilic acid, by the mineral acids, is easily and completely dissolved in pure water.

Bilic acid is not volatile; heated on a sheet of platinum, it melts, swells up, burns with a very smoky flame, and leaves a voluminous charcoal, which, when it is freed from alkaline bases, burns without any residue. The acid prepared according to Demarçay's process, always furnishes a very alkaline residue. When the acid leaves an alkaline ash, after combustion, it contains undecomposed bile, which remains in solution when it is deprived of free acid by digestion with oxide of lead. The less the separation of the soda has been complete, the more bile remains in the liquid. It is easy to ascertain that the substance remaining in solution is really bile, as it furnishes, by dilute sulphuric acid, absolutely the same products as bile itself, as it is precipitated by basic acetate of lead, and as it leaves carbonate of soda after calcination.

Demarçay and Dumas obtained the following results by the analysis of bilic acid incompletely freed from all the alkaline bases; the nitrogen was determined in the state of gas.

	I.	II.	III.	Dumas.
Carbon ..	63·818	63·707	63·568	63·5
Hydrogen	9·054	8·821	8·854	9·3
Nitrogen.	3·345	3·255		3·3
Oxygen..	23·779	24·217		23·9

If we compare these with those numbers which Kemp, Theyer, and Schlosser obtained by the analysis of pure bile, from which they determined the proportion of nitrogen in the state of ammonia, we cannot retain the slightest doubt concerning the absolute constancy of the composition of bilic (choleïc, bilifellic) acid contained in the bile of the ox, for the analyses were made with bile and bilic acid obtained at quite different countries; nor can it be doubted that bilic acid contains the same elements (with the exception of the nitrogen, determined by an imperfect method, and of a quantity of water substituted for the soda) in the same proportion as the organic compound in the bile itself.

If, as has been indicated in the method first described, an alcoholic solution of pure bile be treated by effloresced oxalic acid, if the oxalate of soda deposited be separated by filtration, and if the liquid diluted with water be saturated with carbonate of lime, a bilate of lime with a slightly acid reaction is obtained, from which all the lime may be separated by the addition of carbonate of soda, bilate of soda remaining in the solution, if this liquor be evaporated, and if the residue be dissolved in absolute alcohol, an excess of carbonate of soda remains; the bilate of soda is dissolved; in the dry state, this salt of soda has the appearance of a colorless gum, or of slightly yellowish colophane, and possesses all the properties of pure bile; it has an extremely feeble alkaline reaction; it gives no precipitate by the addition of acetic acid and acetate of lead; mixed with a solution of neutral acetate of lead, it forms a white resinoïd precipitate, after the separation of which, the liquor has an acid reaction. The addition of basic acetate of lead then produces in it a new resinoïd precipitate. The alcoholic solution of bilate of soda is not precipitated by another alcoholic solution of neutral or basic acetate of lead. Nitrate of silver forms in it a white precipitate soluble in warm water. If the aqueous solution be saturated with hydrate of potassa, the bilate of soda is separated from it, under the form of a liquor of the consistence of turpentine. The dilute mineral acids produce in it a turbidness, and it deposits oleaginous drops, which disappear again by an excess of acid. The only difference between this salt and bile, consists in the latter not being rendered turbid when cold, and in a deposit of bilic acid being formed only by a gentle digestion. This acid presents, however, the same properties in both cases. These facts show, beyond doubt, that bile is the soda compound of an organic acid, susceptible of being separated from the base, and of again combining with soda, to form a salt perfectly similar to bile.

ACID BILATE OF SODA.

Biliary substance, according to the former opinion of Berzelius; *bilifellic* acid, according to his latest opinion.

If a solution of bile in absolute alcohol, be freed from coloring matter, by cautiously adding to it baryta-water, if it be filtered, and if sulphurie acid, diluted with half its bulk of water, be added to the clear liquor, there is a separation of the excess of baryta and sulphate of

soda. If the free sulphuric acid be removed by a small quantity of carbonate of lead, and oxide of lead, which is then precipitated by sulphuretted hydrogen, and if the liquor be evaporated, a colorless, or very slightly yellow mass, possessing the taste of bile, remains, which may be freed from the fatty acid which it retains, by treatment with ether. It attracts moisture from the air; it readily dissolves in all proportions in water and alcohol, and is insoluble in ether; the aqueous solution reddens litmus (Berzelius). It leaves, after calcination, a powerfully alkaline ash. If the alcoholic solution of pure bile be freed by sulphuric acid (exactly following the process of Berzelius) from the bases precipitable by this acid, if it be afterwards saturated with carbonate of soda, and if it be completely evaporated and treated with alcohol, the latter dissolves a combination of soda identical in its properties with pure bile; its solution is not rendered turbid by acetic acid, nor by an excess of hydrochloric acid; it furnishes 11·50 of an ash which contains 11·13 of carbonate of soda, and 0·37 of chloride of sodium. The elementary analysis gave:—

Carbon	58·80	60·38
Hydrogen	8·51	8·74
Nitrogen	3·40	3·74
Oxygen, Soda, Chloride of sodium	29·29	27·14

The numbers of the foregoing prove, that pure bile does not undergo any other change in its treatment with sulphuric acid, than a separation of a portion of the base. A new combination with soda, reëstablishes the original composition.

If the aqueous solution of acid bilate of soda, prepared according to the process of Berzelius be treated by oxide of lead, this oxide agglutinates in the form of a plaster; the free acid combines with free oxide of lead, whilst a small quantity of bilate of lead and neutral bilate of soda, that is to say, bile with all its properties, remains in solution; this is proved by the basic acetate of lead completely precipitating from it every substance with a bitter taste (Enderlin), Berzelius, who was ignorant of the property which pure bile possesses of being precipitated from its aqueous solution, by basic acetate of lead, regarded the body which remains in solution, as a peculiar substance which he designates under the name of *bilin;* but, this bilin does not possess any property which distinguishes it from pure bile.

The action of mineral acids on bilic acid, gives rise to several products of decomposition, namely, choloïdic acid, taurine and ammonia; Demarçay submitted the first two to analysis. The action of caustic potassa on bilic acid, decomposes it into ammonia, carbonic, and cholic acids.

The following is the composition of choloïdic and cholinic acids*:—

	Choloïdic acid.				Cholinic acid
				Dumas.	Dumas.
Carbon	73·522	73·301	73·156	73·3	68·5
Hydrogen	9·577	9·511	9·477	9·7	9·7
Oxygen	26·901	27·188	27·367	27·0	21·8

If, taking for a basis the analysis of bile, and those of cholëic acid, as well as of the products of its decomposition by the acids and alkalis, we try to deduce from it these metamorphoses, we obtain, as the nearest approaching expression of the composition of the hydrated cholëic acid, the formula:—

$$C^{74}H^{133}N^{1}O^{22}$$

By deducting from this formula the elements of taurin..... $C^{4}H^{14}N^{2}O^{10}$
Of ammonia..... $H^{6}N^{2}$
$$\Big\} - C^{4}H^{20}N^{4}O^{10}$$

We arrive at the formula of choloïdic acid ..... $C^{70}H^{112}O^{12}$

If we deduct from the elements of cholëic acid the elements of two atoms of carbonic acid, and of two equivalents of ammonia, a formula remains which much resembles the composition of cholinic acid. By taking these results as a basis of calculation, the following would be the theoretical composition of these bodies:—

* Demarçay has given to the substance here called cholinic acid the name of *cholic acid*, which should be applied to the acid discovered by Gmelin.

	Bilic acid (choleïc). $C^{76}H^{132}N^{4}O^{22}$	Choloïdic acid. $C^{72}H^{112}O^{10}$	Cholinic acid. $C^{74}H^{120}O^{18}$
Carbon	63·24	74·4	68·9
Hydrogen	8·97	9·4	9·2
Nitrogen	3·86		
Oxygen	23·95	26·2	21

If we designate the formula of bilic acid by Ch, and admit that in bile the double number of elements of bilic acid is combined with three atoms of soda, 6·66 of soda should be found in 100 parts; Kemp obtained 6·53 per cent: a greater accordance can scarcely exist in investigations of this nature.

If, according to Berzelius, the action of hydrochloric acid on pure bile (in its metamorphosis by this acid), be incomplete, or, if it be continued after the decomposition of the choloïdic acid, several intermediate products which are very imperfectly known, are formed.

If, for example, the substance obtained by boiling hydrochloric acid with pure bile (choloïdic acid) be treated by alcohol of the specific gravity of 0·84, all is not perfectly dissolved, but there remains a resinoïd body, sparingly soluble in boiling alcohol, and which is deposited under the form of a white earthy powder. Berzelius calls this substance *dyslysine* (from δυσ, difficult, and λυσισ, solution).

If the alcoholic solution (of choloïdic acid) be saturated with ammonia, and evaporated, a resinoïd mass is separated during the evaporation, which forms a still more considerable residue, when the liquor is evaporated to dryness and treated by water.

The aqueous solution, obtained in the latter case, gives, with hydrochloric acid, white flocks, which gradually collect and agglutinate into a solid, hard, and friable body. This substance fuses at above 212° F. into a limpid mass, which, after cooling, is hard and transparent, resembling colophane; boiled with water it becomes soft, and gives a turbid solution of a slightly bitter taste, and with an acid reaction. This body is very soluble in alcohol as well as in the alkalis: its combinations with the alkalis are completely precipitated from their aqueous solution, by the caustic or carbonated alkalis; they are soluble in alcohol, and give, with the salts of baryta, a white plastic precipitate. Berzelius calls this body *fellic acid;* it appears to be only a combination or a mixture of the following with unaltered bilic acid. The above-mentioned resinoïd mass, which resists the solvent action of water, after the evaporation of the ammoniacal solution of choloïdic acid, is divided with hydrochloric acid, at the ordinary temperature, into light, white flocks, which assume the appearance of a resin when washed with water, and which are softened and may be kneaded in hot water. A solution of this substance in alcohol gives, by the addition of a solution of potassa, a combination soluble in water and in alcohol, which precipitates the salts of baryta. The principal difference between this substance, which Berzelius calls *cholinic acid*, and the foregoing, consists in its swelling in the alkalis without dissolving in them, or without afterwards dissolving in water.

Purified bile gives no precipitate when mixed with baryta-water or chloride of barium and ammonia; a proof that neither of the two bodies just described is found in it ready formed.

GMELIN'S CHOLIC ACID.

If the precipitate, obtained by the acetate of lead in the aqueous solution of the alcoholic extract of bile, be divided in water and distilled vinegar, if it be decomposed by sulphuretted hydrogen, and, if the liquor be evaporated, fine needles of cholic acid are obtained, which are purified by repeated crystallizations. A greater quantity of acid is separated from the sulphuret of lead, by boiling the latter with alcohol, adding water to the liquor, freeing it from the resinous body which is separated, and evaporating it to crystallization.

In the purified state, cholic acid is in fine, white needles, which, by pressure between leaves of paper, agglutinate under the form of bracteæ of a slightly acrid taste: the crystals readily dissolve in alcohol, very difficultly in cold water, and more easily in warm water; the solutions redden litmus. The crystals fuse at a high temperature, and furnish, by distillation, a thick, brown oil, and a powerfully ammoniacal liquor; this acid burns in the air with a strong smell of horn. Nitric acid and concentrated sulphuric acid, decompose it with heat; it dissolves, without coloration, in cold sulphuric acid, and is precipitated from it by water; it forms, with soda, a crystallizable salt.

According to Gmelin, cholic acid does not precipitate the neutral acetate of lead, and forms a turbidness with the basic acetate; cholate of ammonia does not precipitate the salts of lead, according to Fromherz and Gugert. It is, therefore, probable that cholic acid does not exist ready formed in the bile, but that it is a product of the decomposition of bilic acid: the nitrogen which it contains essentially distinguishes it from the cholinic acid of Demarçay.

Berzelius mixed an aqueous solution of the alcoholic extract of bile, with carbonate of potassa and boiled the mixture for some hours; then he evaporated, until, by the concentration of the liquor, the bile (altered) again separated on its surface; he decanted the colorless alkaline liquor; he dissolved the portion separated in water, and precipitated by acetic acid: a white precipitate was then deposited under the form of a shining mass, presenting a tissue of fine crystals, which possessed all the properties of the cholic acid of Gmelin.

CHOLANIC ACID.

Some putrefied bile, which had become semi-fluid by long keeping, was freed, by ether, from all the substances soluble in that liquid; it was then dissolved in alcohol, and decolored by baryta-water; it then furnished, after the dissipation of the alcohol, a pale yellow residue, which was dissolved in water. This solution gave, by the addition of acetic acid, a plastic precipitate, which caustic ammonia easily dissolved.

The ammoniacal solution diluted with 100 parts of water deposits a white precipitate after a strong boiling. If this precipitate be dissolved in ammonia, and if chloride of barium be added to the liquor, a white, insoluble salt of baryta is precipitated, which, boiled with carbonate of soda, gives carbonate of baryta, and a soluble salt of soda. By the addition of hydrochloric acid to the solution of this salt of soda, a white, floculent body is obtained, not agglutinated, which possesses the principal properties of the choloïdic acid described by Demarçay. Berzelius calls this substance *cholanic acid*.*

FELLANIC ACID.

The solution of the ammoniacal salt, which deposited the white precipitate by ebullition, gives, with hydrochloric acid, a plastic precipitate, which, treated by ether and water, leaves a white powder with acid properties. Berzelius calls this substance *fellanic acid*. The characteristic property of this fellanic acid is, to form with baryta, a salt sparingly soluble in cold water, more soluble in warm water, and which separates, by cooling, from this solution as well as from that in hot alcohol, in colorless transparent prisms. The names *fellic*, *cholinic*, *fellanic*, and *cholanic acids*, do not refer to well-characterised peculiar bodies, but have been chosen only for designating certain alterations which the organic substance of the bile has undergone by decomposition.

The yellowish-green, or dirty green substance, on which the color of bile depends, is removed, as I have already said, by simple treatment by animal charcoal, a proof that it does not belong to the composition of the combination of soda.

The most important result of some new investigations, which I have related above, is, that the bile is completely precipitated by the acetate of lead, that thus there does not remain in the solution any neutral substance, not precipitable by the salts of lead, *bilin*. The plastic precipitate which is formed in these circumstances is not entirely insoluble in water; the acetate of soda which remains in solution, increases its solubility. If, for example, the precipitate produced by the addition of the basic acetate of lead to bile be separated, by filtration, if the excess of the salt of lead be precipitated by sulphuretted hydrogen, and if it be evaporated to dryness, there remains acetate of soda, which contains a small quantity of bilic acid. If, then, a little pure bile be added to a solution of this residue, this liquor is not precipitated by basic acetate of lead, although the bile, without the acetate, is easily and completely precipitable. If the aqueous solution of bilic acid, perfectly freed from bases, be put in digestion with oxide of lead, there remains in the liquor only a small quantity of the salt of lead, but no bilin.

* The properties of this substance are entirely different from those of the *cholic acid* of Demarçay, which has been described at p. 12, under the name of *cholinic acid*.

CONTRIBUTIONS TO THE HISTORY OF THE IODIDES.*

BY M. LABOURE'.

The soluble iodides are capable of dissolving iodine in variable proportions, according to the degree of concentration of the solution of iodide; the quantity of iodine dissolved, is in direct ratio with the concentration. Baup and other chemists have regarded the ioduretted iodides as definite compounds. For my part, I cannot admit their view, for all facts are opposed to it.

I. These products are uncrystallizable, and immediately color the filters and organic matters as iodic acid does:

II. In contact with a solution of starch, there is an immediate blue coloration:

III. Treated by ether, the iodine is dissolved, whilst the iodine remains in solution in the water, and forms, at the lower part of the tube, a transparent and colorless layer:

IV. If a current of sulphuretted hydrogen gas be driven into the solution, hydriodic acid and a deposit of sulphur are formed,

* *Journal de Pharmacie*, Nov., 1843.

and the solution becomes colorless. A solution of an alkaline iodide saturated with iodine, may be very advantageously employed for preparing hydriodic acid; it may be obtained almost fuming, but it is necessary to have recourse to distillation, which always gives a colored acid:

V. Finally, the iodureted iodides, in contact with iron filings, are decolored in proportion as the iron combines with the iodine, at the same time, as there is an elevation of temperature. According to these characters, which are those of free iodine, I consider the iodureted iodides, as simple solutions of iodine in the iodides, and not as combinations.

I have observed, conjointly with M. Cloez, my colleague, that, by treating the iodide of potassium by concentrated sulphuric acid, a disengagement of sulphureted hydrogen is always obtained, which can arise only from the decomposition of the sulphuric acid. This acid acts with much energy, and with production of heat. Violet vapors of iodine are formed, which become brown, and are condensed in the top of the tube into a liquid of the same color; amongst the gases which are disengaged, we have especially remarked sulphurous and hydrosulphuric acids; iodine is also separated, and remains at the bottom of the tube. This decomposition is very complex and difficult to explain, as much from the number of the products which are formed, as from the difficulty of separating them. Hitherto, in the preparation of the mother liquors of the soda of Warechs, the disengagement of hydrosulphuric acid had been attributed, exclusively, to the accidental presence of sulphurets in the mother liquors. According to M. Cloez, the oxygen of the sulphuric acid combines with the iodine to form iodic acid. Notwithstanding all my endeavors, I have not been able to prove its presence, so that I am still ignorant of what becomes of the oxygen; but I hope soon to devote myself to new investigations, which will, perhaps, be more satisfactory.

I have since remarked, that iodide of potassium is not the only iodide which gives hydrosulphuric acid, but that most of the soluble iodides also furnish it when treated by sulphuric acid, whilst most of the insoluble iodides are, more or less, easily attacked by this acid, with or without the concurrence of heat, and give, for the most part, only sulphurous acid, a sulphate and iodine, without the slightest trace of hydrosulphuric acid.

According to Thènard, hydrochloric acid should be without action on the iodides; however, it decomposes a great number of them, and gives different products. According to Serrulas, liquid hydrochloric acid decomposes iodide of nitrogen; the iodine is converted into iodic and hydriodic acids, fixing the oxygen, and a portion of the hydrogen of the water decomposed, whilst the other portion of hydrogen unites with the nitrogen, forming ammonia, which enters into combination with the hydrochloric acid. According to Serrulas, almost at the same time, the excess of hydrochloric acid determines a reaction between its own elements and those of the iodic and hydriodic acids, so that water and a subchloride of iodine result, the latter remaining in solution. This second reaction does not occur entirely in this way, for hydrochloric acid has no action on hydriodic acid, and the latter, not requiring the presence of hydrochloric acid, to decompose the iodic acid, it results that the hydrochloric and the hydriodic acids react, at the same time, on the iodic acid, and decompose it, forming water, whilst the chlorine of the hydrochloric acid combines with the iodine arising from the iodic and hydriodic acids, forming protochloride of iodine.

The solid alkaline iodides, those of potassium, barium, sodium, and ammonium, and some others, put in contact with concentrated hydrochloric acid, color it even cold; but if the acid be treated to ebullition, it is colored of a more or less deep yellow; after cooling, if the acid be decanted, and the residue washed several times with alcohol at 40°, in order to remove all the acid and alkaline iodide, dissolved at the same time, a pulverulent residue results, which is only alkaline chloride, which completely dissolves in water, and gives, with nitrate of silver, a white precipitate of chloride of silver, soluble in ammonia.

The iodide of zinc dissolves, without heat, in hydrochloric acid, and imparts to it a yellow color.

Hydrochloric acid does not, sensibly, alter, without heat, the yellow iodide of lead; but, by boiling, the iodide is completely dissolved, if there be sufficient acid; the solution is limpid, and of a slight reddish-yellow; it abandons, by cooling, crystalline needles of a pale yellow, sometimes grouped in *aigrettes* and *angles*. After having decanted the acid, they are promptly washed, two or three times, with distilled water, for they are decomposed by a prolonged contact with water. These crystals are composed of chloride and iodide of lead (chloro-plumbate of protiodide of lead).

The iodides of antimony and bismuth dissolve, with ebullition, in hydrochloric acid, and color it red. According to Rammelsberg, iodide of lead does not combine with ammonia by the humid way, but only

by the dry way, forming a white mass composed of Pb^2, N^2H^6, however; this product may be obtained by the humid way, by putting iodide of lead, either amorphous or crystallized in water: in contact with caustic ammonia, it becomes whitish, and, after a few days' contact, a white pap is obtained, which does not change in the air in drying, and which is iodo-plumbate of ammonia; by heat, ammonia is disengaged.

According to Rammelsberg, protiodide of copper dissolves, although in small quantity, in liquid ammonia, without coloring it, but no combination is obtained by the humid way. However, I have obtained this compound by means of a salt of protoxide of copper, prepared by M. Levol's process, by supersaturating with ammonia, the solution of a salt of binoxide of copper, then putting some sheets of copper into the liquid, filling the flask with boiled distilled water, and sealing it with emery; it is, occasionally, stirred until it is decolored. The iodide of pottassium in solution is put into an eprouvette, and the protosalt of copper is poured in; the eprouvette is immediately closed; a white crystalline precipitate is formed, and, at the same time, white prismatic crystals are deposited on the sides of the eprouvette, these crystals, as well as the precipitate, are formed of protiodide of copper and ammonia (iodo-cuprite of ammonia). They cannot be dried without being decomposed; as soon as they are withdrawn from the liquor, they disengage ammonia, and become of a green color. The liquor in which the crystals are deposited, remains for a few moments colorless, but it gradually becomes blue, and is converted into a compound of biniodide of copper and ammonia (iodo cuprate of ammonia).

Protochloride of tin decomposes the iodides of mercury. The protiodide, in contact with its solution, gradually becomes a greenish black, then entirely black, and afterwards the mixture is of a slate grey, on account of the oxide of tin which is precipitated, and weakens the black color.

Biniodide of mercury, in the same circumstances, becomes of a yellowish-red, then yellow, then perfectly green, and is, gradually, reduced to the state of protiodide. If there be an excess of chloride of tin, it is decomposed, as above, finely divided metallic mercury and oxide of tin are precipitated, and the liquor contains hydriodic and hydrochloric acids, retaining the tin in solution.

The alkaline and other soluble iodides, those of ammonia, magnesium, iron, zinc, &c., decompose protochloride of mercury: this fact appears very extraordinary, when we reflect upon the little stability of the protiodide of this metal.

The solid iodides, or those dissolved in distilled water, likewise operate its decomposition; at the point of contact, protochloride of mercury acquires a greenish-grey tint: if the mixture be triturated in a mortar, it becomes a dark green; placed in the dark it may remain green for a very long time, notwithstanding the presence of an alkaline iodide, whilst, if it be exposed to the light, the decomposition is much more promptly effected; from green, the mixture passes to yellow, then to red, globules of metallic mercury being seen at same the time. In these different reactions, the calomel is changed into the protiodide and alkaline chloride, as is easily demonstrated by treating the green mixture two or three times by alcohol at 40, which removes all the excess of alkaline iodide, the residue is then treated by distilled water, which dissolves the alkaline chlorides, which may be crystallized, and which it is easy to detect by nitrate of silver, which gives a white caseous precipitate of chloride characterized by its solubility in ammonia. After these two treatments, the residue is dried, which is a mixture of protiodide of mercury and calomel, then it is heated in a tube, sealed at one end; the protiodide of mercury is partially decomposed, disengages vapors of metallic mercury, which condense in small globules, and form a first ring of a greyish-white; immediately below is deposited a second greenish-yellow ring, of sesqui-iodide of mercury; finally, the calomel being less volatile, ultimately sublimes, and forms a white ring below the foregoing.

With regard to the change of color, of the green mixture, by its exposure to the light, after several days, it is due to the secondary action exerted by the alkaline iodide on the protiodide of mercury.

Protochloride of mercury may be entirely decomposed by an excess of alkaline iodide, as is seen by heating an intimate mixture of calomel and alkaline iodide in excess; the mixture passes from green to yellow, then to red, enters into fusion, and becomes of a black-brown; metallic mercury and biniodide of mercury are sublimed, in consequence of the decomposition which the protochloride undergoes in presence of the alkaline iodides. When nothing more is disengaged, if the tube be cut near its base with a file, the residue which it contains is whitish, entirely soluble in water, and composed of alkaline chloride, mixed with the excess of alkaline iodide.

Most of the double iodides are decomposed by water; the electro-positive iodide is dissolved, whilst the electro-negative

iodide is precipitated; that is observed as regards the double iodides, of protiodide of tin, iodide of lead, biniodide of mercury, iodide of silver, &c.

According to M. Boullay, when biniod-hydrargyrate of iodide of potassium is treated by water, one atom of biniodide of mercury is separated, and protiod-hydrargyrate of iodide of potassium remains; but this compound does not really exist; for it is sufficient to separate the biniodide which is precipitated, and to concentrate the liquor, to obtain crystalline needles of biniod-hydrargyrate of iodide of potassium, which are mixed with small cubes of alkaline iodide.

Among the double iodides, the biniod-hydrargyrate of iodide of potassium has the property of dissolving, by boiling, one atom of biniodide of mercury, and of precipitating the whole of it, by cooling, under the crystalline form. Boullay also considered this boiling iodide as a tris-iod-hydrargyrate of iodide of potassium, which is decomposed by cooling; but this compound does not exist any more than the preceding.

The other compounds of biniodide of mercury, with the alkaline iodides, and those of ammonium, magnesium, iron, and zinc, act like the bin-iod-hydrargyrate of iodide of potassium.

PREPARATION OF IODIDE OF BARIUM.

The process which I propose, is of easy execution. I take sulphuret of barium, obtained by the calcination of sulphate of baryta with charcoal; after each treatment by boiling distilled water, I allow the solution to settle a moment in the matrass, then I decant the limpid liquor, without it being necessary to filter it, and I immediately pour into it some solution of protiodide of iron (which is easily procured by putting iodine in contact with distilled water, and a slight excess of iron filings).

The sulphuret of barium and the iodide of iron are decomposed into soluble iodide of barium and insoluble sulphuret of iron, which is always mixed with oxide of iron, precipitated by the hydrate of baryta.

When it is considered to be near the point of saturation, a small quantity of the liquor is filtered, and when it is no longer precipitated by iodide of iron or sulphuret of barium, which indicates that the decomposition is complete, and that an excess of iodide of iron has not been added; the liquor, which is colorless, is filtered, and is received into a capsule, and evaporated to a pellicle in a sand-bath; the capsule is then removed, and, by cooling, six-sided prisms of iodide of barium are formed; the mother-liquor, which is colorless, is separated, the crystals are set to drain in a glass funnel, and as soon as no more liquid flows out, they are confined in a very dry flask sealed with emery, whose size should be proportionate to the quantity of iodide to be put into it, otherwise the crystals are colored after a certain time. When it is desired to have the iodine crystallized, the liquors must be immediately evaporated to dryness, stirring continually, and at a gentle heat. In this operation the liquors must not be left long exposed to the air, or they will be colored.

PREPARATION OF HYDRIODATE OF AMMONIA.

In the preparation of hydriodate of ammonia, we operate as in the case of iodide of potassium, substituting carbonate of ammonia for carbonate of potassa; only to obtain a white salt, care must be taken to constantly maintain in the liquors a slight excess of ammonia, so long as the evaporation lasts. Notwithstanding the addition of ammonia, a white salt is not always obtained: when it is colored, it is sufficient to triturate it in a mortar, and to expose it in a current of dry air, to a heat of from 68° to 77° F.; after a few hours, the iodine which colored it is disengaged and the salt is perfectly white. Then, if it be wished to crystallize it, it must be dissolved in liquid ammonia, saturated, when boiling, in a matrass; it is afterwards corked, and, by cooling, the iodide crystallizes in small, very white cubes; it is promptly dried in a stove, heated not above 77° F., and is confined in a well-corked flask, of such a capacity, that the iodide may completely fill it.

In this preparation the carbonate of ammonia may be advantageously replaced by caustic ammonia; more concentrated liquors are thus obtained, for it is necessary to employ a very large quantity of water to dissolve the carbonate of ammonia.

ON SOME DOUBLE SALTS OF OXALIC ACID.*

BY G. A. KAYSER, OF HERMANNSTADT, IN TRANSYLVANIA.

The following investigations, carried on in the laboratory of Dr. Rammelsberg, have relation to some double oxalates, the existence

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* *Annalen der Physik und Chemie von J. C. Poggendorff, Band LX., Stück 1.*

of which was hitherto either unknown, or but imperfectly established.

AMMONIACAL OXALATE OF ZINC.

To the hot solution of the double oxalate of ammonia, freshly precipitated carbonate of zinc was added to saturation, and the whole was digested for some time. This gave rise to a precipitate, which proved to be oxalate of zinc; the liquid was filtered from it, and evaporated. On cooling, crystals were formed, which were of a milky white color, and in papillary groups. On examination, the salt was found to contain ammonia as well as oxide of zinc. It is almost insoluble in cold water; in hot water it is decomposed, oxalate of zinc being separated; exposed to the air for a longer time it effloresces, losing part of its water.

I. 1·65 grammes of this salt were dissolved in hydrochloric acid. The oxide of zinc determined by the oxalate of soda, was =0·29. The oxalic acid thrown down in the usual manner by the chloride of calcium, furnished 1·07 of carbonate of lime, which corresponds to 0·763 of oxalic acid.

II. 0·59 grammes of this salt were calcined, in order to determine the oxide of zinc, furnishing 0·1 = oxide of zinc. 1·45 grammes of it were boiled with water and potassa, with the view of determining the ammonia; the ammonia was received into hydrochloric acid, and determined by chloride of platinum. The well-dried ammoniacal chloride of platinum was = 3·18 = 0·244 ammonia.

	I.	II.	Atoms.	Calculated.
Ammonia ..		16·86	2	15·08
Oxide of zinc	17·58	16·95	1	17·69
Oxalic acid..	46·24		3	47·46
Water.....			5	19·77
	100			100

Hence the formula of this double salt is :—

$$\dot{Zn}\dddot{C} + 2\dot{N}H^4\dddot{C} + 3\dot{H}.$$

POTASSIO OXALATE OF ZINC.

Into the very concentrated boiling solution of the neutral oxalate of potassa was put some dry oxalate of zinc; a visible effect ensued, part of it being dissolved. The liquid was filtered, after having been digested for some time with the oxalate of zinc. On cooling, a salt crystallized under the form of small transparent tables. It was sparingly soluble in cold water, and was decomposed by hot water, oxalate of zinc being separated. It effloresced in the air; 1·5 grammes of the salt, on being heated to + 200° C. (+ 392° F.) lost 0·31 water. The dried salt was then calcined, and the carbonate of potassa formed in this way washed with hot water. The residue amounted to 0·28 of oxide of zinc. The liquid was then mixed with hydrochloric acid and evaporated; it left 0·59 chloride of potassium = 0·3732 potassa.

	Found.	Atoms.	Calculated.
Oxide of zinc....	18·66	1	19·69
Potassa	24·88	1	23·09
Oxalic acid.....		2	35·22
Water.....	20·66	5	22·00
			100

Formula :—$\dot{Zn}\dddot{C} + \dot{K}\dddot{C} + 5\dot{H}$.

POTASSIO OXALATE OF MAGNESIA.

To the boiling concentrated solution of the neutral oxalate of potassa was added freshly precipitated oxalate of magnesia, so long as it was productive of an effect; then it was boiled with an excess of that salt, and filtered. On cooling, a salt crystallized in papillary agglomerated crystals of a milky white color. It is sparingly soluble in cold water, and is decomposed by hot water, the oxalate of magnesia being separated; it effloresces considerably in the air. 1·285 grammes of the salt were heated to 200° C. (+ 392° F.) with the view of determining the amount of water it contained; this quantity lost 0·35. The salt was then calcined, and the carbonate of potassa formed in that manner lixiviated with hot water. The calcined residue gave 0·11 magnesia. The solution of the carbonate of potassa was mixed with hydrochloric acid and evaporated; it furnished 0·52 chloride of potassium, = 0·3289364 potassa.

The composition of this salt found by analysis, and calculated, is as follows :—

	Found.	Atoms.	Calculated.
Magnesia	10·83	1	10·66
Potassa	25·59	1	24·34
Oxalic acid.....		2	37·15
Water.....	27·62	6	27·85
			100

Formula :—$\dot{Mg}\dddot{C} + \dot{K}\dddot{C} + 6\dot{H}$

AMMONIACAL OXALATE OF MAGNESIA.

To a boiling concentrated solution of the neutral oxalate of ammonia was added oxalate of magnesia, so long as it produced an effect, then it was boiled for some time with an excess, and next filtered. On cooling, a salt was obtained crystallized in papillary groups of a milky white color. It is soluble in cold as well as in hot water, but the solution is rendered turbid by oxalate of magnesia. It effloresces in the air.

I. 1·015 grammes of the salt were boiled with water and potassa, and the ammonia received by hydrochloric acid was determined by chloride of platinum. It yielded ammoniacal chloride of platinum = 2·85 = 0·219222 ammonia.

3·135 grammes of the salt on being calcined left 0·13 magnesia as a residue. The small quantity of magnesia leads to the belief that the double salt sought for is mixed with the oxalate of ammonia; it was tried again to produce it in the following way:—

The boiling solution of the binoxalate of ammonia was saturated by the carbonate of magnesia and kept boiling for some time; a precipitate was thrown down which proved to be oxalate of magnesia: the liquid was filtered and evaporated; on cooling, a salt crystallized, which was endowed with the same properties as the former.

II. 0·64 grammes were calcined, and yielded 0·025 magnesia. 0·725 grammes were dissolved in water impregnated with hydrochloric acid, and the oxalic acid determined by the aid of chloride of calcium and ammonia; it yielded 0·54 carbonate of lime = 0·3851 oxalic acid.

The same composition having again been found, it shows that the salt is not a mere aggregation. Its composition may, therefore, be expressed by the following numbers: —

	I.	II.	Atoms.	Calculated.
Magnesia..	4·14	3·9	1	4·44
Ammonia	21·59		6	22·11
Oxalic acid		53·11	7	54·13
Water			10	19·32
				100·00

In all the calculations the atom of oxalic acid is fixed at 450.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

THE OPERATION OF EXCISE RESTRICTIONS UPON THE PROGRESS OF CHEMICAL SCIENCE AS APPLIED TO THE ARTS AND MANUFACTURES OF THIS COUNTRY.

LETTER I.

To the Editors of The Chemist.

GENTLEMEN,—

I VENTURE to trouble you with a few remarks which, at first sight, may appear to have a *political* tendency; but, being well aware that politics and political feeling ever ought to be carefully avoided in a journal devoted to science, I hope to be able to treat the subject to which I wish to call the attention of your readers, so as to satisfy you and them that the encouragement of chemistry applied to manufactures, is the sole object of my addressing you.

The attention of Governments, in all civilised countries, is now being called to the policy of establishing schools for the study of design, of chemistry, and of natural philosophy: but only a small portion of good is done, if, when your pupils are educated and commence life,—full of enthusiasm to apply the knowledge they have gained to the improvement of manufactures dependent upon it,—they find that the great staple manufactures of the country are so surrounded by restrictions and fiscal regulations as to preclude the practical application of the knowledge they have for years been accumulating.

If we were to inform a foreigner, who had never heard of Excise regulations, that in England manufacturers are precluded from trying experiments to improve their manufacture, except in the presence of, and under the espionage of Government ambulating officers, who, passing hourly from the works of the most intelligent to those of the most ignorant, but more crafty, carry from one to the other in a few words the results obtained from months and weeks of toil and reflection, he would not believe such a state of things could have been tolerated; and certainly it is a remarkable circumstance, that, in this country, of all others, a system should exist calculated at once to place the ignorant on a par with the intelligent—to give advantages to the fraudulent over the honest manufacturer. But so it is: and strongly feeling how much the improvement of three important manufactures—dependent on a knowledge of chemistry for their successful prosecution—is retarded by the regulations necessary to collect an Excise duty, I propose to consider the state of the manufactures of glass, paper, and soap, with reference to the progress of chemical science, and its application to other manufactures equally requiring a knowledge of chemistry, which have not been harassed and retarded by the prying inquisitiveness of excise-

men, and the destructive operation of Excise laws. It is not my intention, as I stated at first, to treat the question politically; I shall therefore leave the financial view of the subject to others, to be argued in more fitting places; but I hope in future papers to convince your readers that so long as manufacturers, in the management of their processes, are obliged to obey Excise laws, it will be impossible for them to take advantage of the discoveries which chemistry is daily opening to them, or adequately to encourage or reward those whose intelligence and industry are wasted for want of that assistance of apparatus and space, which any practical man would be happy to afford, could he secure to himself the results of his experiments, which is utterly impossible, so long as the permission of the Commissioners of Excise is required previously to the introduction of a new process, or making any alteration in the apparatus.

Having proved this to your readers—readers engaged in experimental chemistry, to whom the power of practically working out the results of their experiments in the laboratory, in large manufactories, is of the utmost importance, I shall trust to their using every proper opportunity to enforce their convictions on the minds of those who alone have the power to remove such unscientific laws from the statute book.

Should you encourage me by the admission of this paper, I will, next month, enter upon my subject.

I am,
Gentlemen,
Your obedient servant,
H.

ON THE MANUFACTURE OF GUNPOWDER, AND ON THE PROPORTIONS OF INGREDIENTS USED BY VARIOUS NATIONS; WITH THE MODES OF PREPARING THE VARIOUS COLORED FIRES, SIGNAL ROCKETS, &c.

To the Editors of The Chemist.

Gentlemen,—

Being in possession of some very good proportions for making the various colored fires, now so generally used by pyrotechnists in artificial and other fireworks, I have taken the trouble to reduce these compounds to the proportion of the hundred parts, in accordance with what is done by various nations, in preparing gunpowder; and in order that I may be able to embody all the information on this subject in my possession, and for the sake of making the whole a matter of general interest to your numerous readers, I shall commence this subject with a statement of some of the most useful proportions of ingredients used in the manufacture of gunpowder, by different nations, considering gunpowder and its elements to be the soul of pyrotechny, and that a knowledge of its proportions and manufacture must be found generally useful.

Gunpowder, as is generally known, is a compound of saltpetre, sulphur, and charcoal, and its goodness depends more on the intimate combination of its ingredients than on their positive purity. Their purity is, however, of very great importance, all other things being considered. The proportions may vary according to the use made of it, as follows:—

	Common Powder.	Shooting Powder.	Shooting Powder.	Miner's Powder.
Saltpetre..	75·0	78	76	65
Charcoal..	12·5	12	15	15
Sulphur ..	12·5	10	9	20
	100·0	100	100	100

The following, however, are the most approved proportions of ingredients employed by the English, French, United States, Russian, and Chinese Governments; to which is added the best theoretical proportion, as recommended in the "Journal of the Royal Institution," Vol. I., page 135. In looking over these tables the reader will not fail to observe the close approximation of the Chinese proportions to the theoretical proportions of ingredients for gunpowder.

THE ROYAL MILLS AT WALTHAM ABBEY.

Nitre	75 lbs.
Charcoal	15
Sulphur	10
	100

THE FRENCH NATIONAL ESTABLISHMENT.

Nitre	75 lbs.
Charcoal	12·5
Sulphur	12·5
	100

THE UNITED STATES OF AMERICA.

Nitre	75 lbs.
Charcoal	12·5
Sulphur	12·5
	100

RUSSIAN POWDER.

Nitre	73·78
Charcoal	13·59
Sulphur	12·63
	100·00

THE CHINESE POWDER.

Nitre	75·0
Charcoal	14·4
Sulphur	9·9
	99·3

THEORETICAL PROPORTIONS.

Nitre	75·0
Charcoal	13·23
Sulphur	11·77
	100·0

Having given the foregoing proportions of ingredients used in the manufacture of gunpowder, I will now proceed to give a description of the processes employed at a highly celebrated establishment; and in order that all may be clearly understood, I shall commence with the preparation of the substances employed.

I.—THE CHARCOAL-MILL.

The charcoal is carefully examined to see that it contain no brands or imperfect coal in it. It is then sifted through a lawn sieve, to separate any light or other matters, and carried to the mill to be ground until it is reduced to a powder sufficiently fine to pass through a bolting sieve of brass wire, calculated to bring it to the same degree of powder that the sulphur and saltpetre must be brought to, and which is absolutely necessary in order to effect an intimate mixture of these three ingredients.

II.—THE SULPHUR-MILL.

The sulphur having been perfectly refined before it is brought to the manufactory, is broken into small pieces and attentively examined before it is laid upon the mill, in order to pick out any particles of extraneous matter, such as pieces of wood, paper, &c. It is then reduced by the mill to a powder fine enough to pass through a bolting sieve of brass wire, upon the same principle as that used for the charcoal.

III.—THE SALTPETRE-MILL.

The saltpetre, having been trebly refined, is melted into cakes, which, before they are broken, must be well brushed with a clean hair-brush, in order to remove any dust or pieces of grit which may have been collected on their surfaces from their having been exposed to the air for any length of time (this precaution is necessary to prevent any accident by explosion during the manufacture of the powder). Having been thus cleaned, they are broken with a wooden mallet, and laid upon the saltpetre mill, and ground small enough to pass through a fine wire sieve, which is worked in a covered hopper, and received into a tub placed under the hopper, and so connected with it by a cushion, that by the weight of the former it presses closely upon the tub, and prevents waste from the finer particles of the saltpetre flying off. This mode of operating is absolutely necessary, because the velocity of the bolting engine would otherwise occasion the saltpetre to form itself into lumps, which would clog the wires of the sieve, and prevent the separation of the powder from that which is imperfectly ground.

IV.—THE MIXING-HOUSE.

The saltpetre, sulphur, and charcoal, having been prepared as above directed, are put into separate bins, and when the charges are to be got in readiness for the powder mill, a quantity of each ingredient for the service of one bed-stone at a time is to be weighed out according to the proportions required. In the Government establishments the proportions for gunpowder are, saltpetre 75lbs., charcoal 15lbs., sulphur 10lbs., for the barrel of 100lbs. weight. The three ingredients being thus weighed, are put into a charge-tub, in the following manner, so as to make the most intimate mixture possible:—

First a layer of charcoal, then a layer of sulphur, a second layer of charcoal, and lastly, a layer of saltpetre. Great care must be taken that these layers shall bear exactly the same proportion relatively to each other, as did the three quantities of ingredients which were weighed off for the charge of one bed-stone. The more frequently these layers can be repeated, in putting the charge into the mixing tub or vessel, the more intimate will be the mixture of of the ingredients. The charge being put into the tub, as above described, a cover is put over it, to which is affixed a wooden instrument with eight prongs, for stirring the charge, so constructed that it can be worked by a handle at top; this operation is performed by a man, and continued until he considers that the ingredients are sufficiently incorporated. The charge is next taken out of the tub, and passed through a fine brass wire sieve into another tub placed under the bottom of a covered hopper, similar to that

used in the saltpetre mill. The whole being received into the tub under the hopper, the wooden stirrer is to be again applied, and used according to the judgment of the mixing-house man.

It is found in practice, that this method of mixing the charges possesses many advantages over the old method, which consisted in reducing the charcoal and sulphur to a fine powder, and breaking the cakes of saltpetre to pieces, about the size of a walnut, with a wooden mallet, and then mixing the charges in a large trough, with a copper shovel, first throwing in the powdered charcoal, then the sulphur, and, lastly, the saltpetre.

V.—THE POWDER-MILL.

The charges, having been prepared at the mixing-house, are deposited in the charge magazines, which are so constructed as to contain the unwrought charges on the one side, and the finished charges on the other. The mill-man takes out an unwrought charge, and places it on the bed-stone as equally as possible; taking great care, at the same time, to make as little dust as possible.

The dust which may fly off from the charge, in loading the mill, must be carefully swept down from the stones, wheels, and curb, as soon as possible; for if left until a charge is nearly wrought, and then swept into the powder, it will render it foul, and for the same reason the workmen should remove the charge already wrought previous to bringing into the mill that which is unwrought.

After a few revolutions of the stones of the mill, so as to level the charge, the mill-man sprinkles it with pure cold water, from a small copper watering-pot; the quantity of water to be used in this case, must depend upon the experience of the mill-man, and the moist or dry state of the mill-stones, which are always more or less affected by the state of the atmosphere. In damp weather, therefore, a much smaller quantity of water is required. The stones at one powder-mill are from three to four tons each, and are moved with a velocity equal to 7½ revolutions per minute, and it has been found in practice, that powder worked under these for three hours, has been of equal strength with other charges worked for five hours, at another mill, belonging to the same parties, when the greatest velocity of the stones is only 4½ revolutions in a minute.

Notwithstanding, it is necessary as a guide to the mill-man, to establish an average time, which is generally three hours, for working the charge, still it must greatly depend upon his judgment, as to how much longer it may be proper to work it; this part of the process depending entirely on the state of the atmosphere; therefore, although a charge may be thought nearly ready for taking off, a dampness may suddenly come on, and render it necessary for it to be worked a considerable time longer. The stones in some mills, revolving with considerable velocity, it is found necessary in these cases to use a wooden instrument called a shover, with which the mill-man pushes the charge towards the inner stone, the pressure of which is sufficient to throw it back for the outer stone to pass over it; were not this precaution frequently used, the composition would, by degrees, work from under the inner stone, and, leaving it, would come in contact with the bed, and an explosion would perhaps be the result.

VI.—I. THE CORNING-HOUSE.

When the charges are brought from the charging magazine, a sample of each mill-man's work is taken, which, after having been granulated by a hand-engine, contrived for that purpose, is sent to the proof-house, to be dried for proof. The next day, the charges, having been carried to the press, (which was formerly, and is yet in some mills, a screw press of large size, but which, in many places, is now superseded by Bramah's hydraulic press), and are carefully laid thereon, so that they may be formed by it into a mass, as equally dense as possible, and are to remain under pressure as long as the state of the atmosphere may require. The quantity of powder mostly pressed at one time, is about 400 pounds' weight. The mass, which is called the pressed cake, having stood a sufficient length of time in the press, is taken out and broken with a large wooden maul, the pieces being carried to a trough called the breaking trough, and reduced by wooden mallets into irregular pieces, of about the size of peas, seven pounds' weight of which is put into a corning-sieve, 32 sieves being contained in the corning-engine, which, at some mills, is worked by a water-wheel. After the engine is loaded the machine is put into motion, and when the corning-house-man observes that the dust from the pieces of composition has passed through the corning-sieve, he puts in a piece of *lignum vitæ*, called a runner, circular, and with convex surfaces, and so constructed as to granulate the press-cake, and make it pass through the holes of the sieve into another sieve, called a hair duster, which allows the dust to separate from the grains, by passing into a trough for its reception, under the corning-engine; after this, the sieves are emptied, and the operation is repeated until the whole of the pressed-cake is granulated. This part of the process being finished, the grains are

passed through a sieve called the separating sieve, the holes in which act as a gauge to prevent the irregular pieces of composition from being forced amongst the corned powder in the hair dusters, which, from the velocity of the corning-engine, would otherwise inevitably happen.

The grained powder is now put into a reel lined with canvass, of such a texture as to admit of the fine grain and dust passing through it, while the large and small grains remain in it, and are glazed by friction; these are afterwards separated into large and fine grain gunpowder, by passing through the proper sieves. The time required for the powder to remain in the reel for glazing is about half an hour. Gunpowder thus glazed is found to keep much longer than that which has not been glazed, and will bear travelling much better.

II. THE DUSTING-HOUSE.

The very fine grain and dust, having been carried to the dusting-house, are passed through the dusting engine, clothed with fine brass wire sieves, to separate all the irregular grains. The dust which is taken from the fine grain is mixed with that which is to be worked, as the operation of glazing clears the large and small grains from dust: these are not brought to the dusting-house.

THE STOVE.

The different sorts of powder are put into frames with canvas bottoms (called stove cases), 2 feet 11 inches long, 3 inches wide, and 1½ inch deep. These are laid upon racks which are fixed up round the stone; a fire is then made in the stove-pot, and continued slowly increasing for 18 hours, until the degree of heat marked by a thermometer, placed in the door of the stove, is 100° F.; the heat is afterwards gradually decreased for 18 hours more, when as soon as the stone is cool enough for the men to go into it, the powder is brought out, and passed through a screen composed of two inclined planes, covered with fine brass wire sieves. This operation is necessary not only to cool the powder, but to remove any dust which may have been formed in drying.

From the screens it is received into wooden barrels, which generally contain 90 lbs., but which would hold 100lbs., if quite full, the space being left that the powder may have room to move in the barrels when they are rolled about; they are thus (after being heaped up) sent to the magazine, samples having been previously taken from each sort of powder, for proof.

The dust produced by screening the stoved powder is sent to the corning-house, in order to have the fine grain separated from it, after which it is mixed with the remains of the dust, and sent to be reworked at the mill.

The stoving or drying of gunpowder is, in some works, effected by a system of steam pipes; the boiler for supplying the steam being mostly a high pressure boiler, is, for safety, placed in a detached building.

THE PROOF-HOUSE.

The master worker of the powder mill, and the mixer of the composition, attend every proof day, at about 8 o'clock in the morning, to see the several samples of powder, taken from the mill-man's charge, proved as to its strength, and exemption from what is called lights; and if the work of any man is found, by these trials, to be badly incorporated, he is chequed accordingly.

This proof is now generally made by the mortar, and the swing-gun eprouvette, a description of which will be given in a future communication.

COLORED FIRES.

Having given in the foregoing part of this communication a general account of the various processes employed in the preparation of the ingredients, and in the manufacture of gunpowder, I shall now proceed to give the proportions of ingredients, which I have found, from long experience, to be best for the various colored fires, now so much used at every respectable display of fireworks.

I shall commence by observing that very great care is required in the preparation of these compounds, as most of them contain the chlorate of potassa as one of the ingredients employed in their preparation, this salt being easily decomposed when in company with any inflammable substances, and as they explode by percussion, or even by very slight friction. This salt, therefore, should be pulverised, or ground fine in a perfectly clean mortar; it matters little whether in a metallic or wedgwood mortar, so long as both pestle and mortar are quite clean. After grinding, the salt should be sifted through a fine lawn sieve, and that which does not pass through is to be again submitted to pulverisation as before; after all the salt has passed through the sieve, it should be kept in a clean, and dry wide-mouthed stoppered bottle, as it is liable

if not quite pure, to attract moisture from the atmosphere. The nitrates of baryta and strontia should also be carefully and finely powdered in a clean mortar, so as to prevent contamination of the one with the other. In fact, it is requisite in all cases to carefully powder separately, and very finely, all the ingredients used for colored fires, as much of the effect produced depends altogether on this circumstance, and on the intimate admixture of their ingredients. I find wide-mouthed pickle jars, fitted with good sound corks, sufficient to contain most of the ingredients, except the nitrate of soda, from its being a deliquescent salt, and the chlorate of potassa, from it attracting moisture as before remarked, when not perfectly pure, should be kept in stoppered bottles.

The various ingredients, having been thus prepared, are to be kept in a dry situation, and are ready for use. In mixing any preparation it will be necessary to exercise the greatest care; a good bone or wooden spatula, and a clean sheet of foolscap or demy paper, is the best to mix them on, especially in cases in which the chlorate of potassa is used. Each ingredient, as it is weighed out, may be readily mixed by these means with the others; the whole being carefully incorporated, and as little force as is necessary being used with the spatula. To effect the part of the process of mixing the ingredients, it will be found necessary, in some particular cases, to pass the composition through a fine lawn sieve; but this trouble, by careful mixture with the spatula, may, in most cases, be avoided. Having said all that is necessary on this portion of the subject, I shall at once proceed to give the best proportions of ingredients for colored fires, selected from a great number in my possession, and shall commence with two or three of the most brilliant—

CRIMSON COLORED FIRE COMPOSITION, SLOW, FOR PANS.

	grains.
Chlorate of potassa	4·248
Nitrate of strontia	67·443
Charcoal*	5·654
Sulphur	22·655
	100·000

This composition, lightly pressed into common teacups, or other earthenware pans, to be fired for illumination, primed with quick match on the tops.

* The charcoal should be always of some soft wood, as alder, dogwood or willow.

CRIMSON FIRE FOR STARS.

	grains.
Chlorate of potassa	17·244
Sublimed sulphur	17·904
Nitrate of strontia	55·197
Sulphuret of antimony	5·517
Fine charcoal	4·138
	99.

This composition requires careful mixing, and is best driven into the smallest sized pill boxes, with very slight taps with a wooden mallet and a short cylindrical stick, first putting a piece of fine quick-match across, allowing the four ends of which to be about half an inch over the edge of the box; a piece of blue touch paper is to be pasted round the upper edge of the box, and, when quite dry, slightly twisted at the top.

COMMON RED FIRE.

	grains.
Nitrate of strontian	72
Sulphur	20
Mealed powder	6
Coal dust	2
	100

GREEN FIRE FOR STARS.

	grains.
Nitrate of baryta	62·587
Sublimed sulphur	10·556
Chlorate of potassa	23·607
Charcoal (fine)	1·625
Sulphuret of arsenic	1·625
	100·000

These stars are to be made up in pill boxes in the same manner as the crimson stars, before directed.

PURPLE FIRE, SLOW, FOR PANS.

	grains.
Chlorate of potassa	41·949
Nitrate of potassa	22·642
Sublimed sulphur	22·631
Black oxide of copper	10·028
Sulphuret of mercury	2·650

To be put up in pans, or old tea-cups, as described for crimson fire.

PURPLE FIRE FOR STARS.

	grains.
Chlorate of potassa	77·419
Sulphur (sublimed)	12·904
Sulphate of copper	9·677
	100·000

To be put up in small paper pill boxes, as directed for crimson and yellow fires. This composition is very liable, in hot situations, to undergo spontaneous combustion; it is, therefore, best not to make it up until wanted.

BLUE FIRE FOR STARS.

	grains.
Chlorate of potassa	69
Sulphur (sublimed)	24
Sulphate of copper	7
	100

To be made up as above. Dangerous to keep from the above cause.

YELLOW FIRE FOR PANS.

	grains.
Nitrate of soda	74·528
Sulphur (sublimed)	19·624
Charcoal	5·848
	100·000

To be burnt in pans or cups, properly matched. The same composition put up in paper pill boxes will answer well for stars; they should be kept in a very dry place, in a stoppered bottle.

WHITE FIRE FOR PANS.

	grains.
Saltpetre	46·570
Sulphur (sublimed)	23·100
Mealed powder	12·275
Zinc filings	18·055
	100·000

Burnt in pans or cups, &c., as before.

WHITE FIRE FOR STARS, ETC.

	grains.
Saltpetre	57·019
Sulphur (sublimed)	28·075
Zinc filings	14·906
	100·000

LILAC-COLORED FIRE FOR PANS.

	grains.
Chlorate of potassa	49
Sulphur (sublimed)	25
Dry powdered common chalk	20
Black oxide of copper	6
	100

Burnt in pans, as before stated.

LILAC-COLORED FIRE FOR STARS.

	grains.
Chlorate of potassa	50
Sulphur sublimed	25
Dry powdered common chalk	22
Black oxide of copper	3
	100

To be burnt in paper pill boxes, &c., as before stated.

I may be allowed to add some of the best proportions of composition for signal rockets:—

FOR THE TWO OZ. ROCKET.

	grains.
Saltpetre (pulverised)	54·545
Sulphur (sublimed)	18·182
Charcoal (fine dogwood)	27·273
	100·000

FOR THE FOUR OZ. ROCKET.

	grains.
Saltpetre (pulverised)	64
Sulphur (sublimed)	16
Charcoal	20
	100

EIGHT OZ., OR HALF-POUND, TO SIXTEEN OZ., OR POUND SIGNAL ROCKETS.

	grains.
Saltpetre (pulverised)	62·745
Sulphur (sublimed)	15·686
Charcoal (fine dogwood, alder, or willow)	21·569
	100·000

In order to obtain the best results with the foregoing proportions of composition for signal rockets, it is absolutely necessary that various compositions, should be driven with considerable force and great regularity into well made paper rocket cases, supported in gunmetal moulds and with gunmetal drifts or rammers, and they are all to be charged on metallic spindles in their centres.

As a general rule it may be stated that the proportions to be observed in the formation of these rockets are as follows:—

The diameter of a leaden ball weighing one pound is the diameter of a one pound rocket; that of the leaden ball weighing half a pound, is the diameter of the half-pound rocket, and so on to the four oz. and two oz. rockets.

The diameter of all sized rockets having been thus determined on, as a rule, the

proportioning of the length to the diameter is another point for consideration. It has been found in practice that three diameters and a half of the interior of each rocket is the proper length of the spindle on which they are to be driven, and that one diameter above that should be all solid composition, for the body of the rocket, a quarter of a diameter of finely powdered dry clay on the top of the composition should be driven in firmly to complete the body of the rocket; this clay has a small hole drilled through it into the composition, so as to form a communication from it to the blasting powder, contained in the head, amongst the stars, which head is attached to the rocket by glueing it on firmly.

ROCKET STARS (BRILLIANT).

Saltpetre (pulverised) ..	52·588
Sulphur (sublimated)	13·147
Antimony (sulphuret) ..	13·147
Isinglass	1·397
Vinegar	6·573
Spirit of wine	13·148
	100·000

The saltpetre, sulphur and antimony, having been reduced to fine powder, separately, are to be intimately mixed through a lawn sieve; the isinglass is to be dissolved in the vinegar, and then added to the other ingredients, and while being incorporated, the spirit of wine is to be added, and the whole well mixed together.

These stars are formed in a brass mould, while in the moist state (about that of slightly moist sugar), on a wooden block, and are afterwards forced from the mould by another round piece of the metal on to a paper tray, and then well dredged with meal powder from a dredger.

TAILED STARS FOR ROCKETS.

Saltpetre	35·161
Sulphuret of antimony ..	17·582
Sulphur	10 790
Meal powder	24·383
Charcoal	12·081
	100·000

The composition having been well incorporated with a small quantity of thin glue or isinglass so as to form a stiff paste, is then to be flattened to about a quarter of an inch thick with a round piece of wood, and afterwards cut out into squares about half an inch thick.

After these stars are formed, they are to be slightly brushed over with linseed oil and dried in the open air, after dredging them with mealed powder.

GOLD RAINS FOR ROCKETS.

Mealed powder	66·666
Sulphur	11·112
Fine charcoal	22·222
	100·000

To be well mixed and charged in strong cases or tubes of paper.

If you think the foregoing communication worthy of a place in your valuable work, THE CHEMIST, you will greatly oblige me by giving it insertion in its columns.

It was my intention to have sent with this paper the process and preparation of ingredients employed for the manufacture of a very strong, but dangerous gunpowder, first prepared by the French, in which chlorate of potassa takes the place of the nitre; on a future occasion, with your permission, I will forward the article for insertion in THE CHEMIST, as also the whole process for the manufacture of a ton of rough saltpetre, and with a table of results, &c., together with the process for extracting saltpetre from damaged gunpowder, and anything else that I think will at all interest your readers in general.

I am,
Gentlemen,
Very truly yours,
JAMES MARSH.

Beresford-street, Woolwich;
December 11, 1843.

[We shall be greatly obliged to our talented correspondent for the papers which he is so kind as to promise us.]

MEMOIR ON THE DISTRIBUTION OR APPROPRIATION OF LANDS.*

BY PROFESSOR LIEBIG.

THE most attentive investigations concerning the animal bodies have shown that the blood, the bones, the hair, &c., as well as all the organs, contain a certain number of mineral substances. If these were not present in the food, their formation could not take place.

The blood contains potassa and soda, as well as compounds of these bases with phosphoric acid. The bile is rich in alkalis; the substance of the muscles contains a certain quantity of sulphur; the red coloring matter of the blood contains iron; the most important principle of the bones is phosphate of lime; the nervous and cerebral substance contains phosphoric acid and alkaline phos-

* *Annalen der Chemie und Pharmacie.*

phates; the gastric juice, free hydrochloric acid.

We know that the free hydrochloric acid of the gastric juice, and a portion of the soda in the blood, arise from chloride of sodium; and, that, by the simple privation of this salt, we put an end to digestion and life.

If we give for nourishment, to a young pigeon (*Chossat, Comptes Rendus de L'Académie des Sciences*, June, 1843), grains of wheat, in which the most important principle of its bones, phosphate of lime, is wanting, and if it be prevented from procuring, elsewhere, the lime which is necessary for it, we perceive that its bones become more and more thin and fragile, and that the continued deprivation of this substance produces death. If we suppress the carbonate of lime in the nourishment of birds, they lay eggs deprived of the hard protective shell.

If we feed a cow with an excess of tubercles and roots, such as potatoes and beet-root, which contain phosphate of magnesia, but only *traces* of lime, the animal experiences the same fate as the young pigeon.

If we remove, daily, from the cow, its milk, a certain quantity of the phosphate of lime, without repairing this loss in its nourishment, this phospate must be taken from its bones, which gradually lose their strength and solidity, and, finally, become incapable of supporting the weight of its body.

If we add to the nourishment of the pigeon, grains of barley, or peas, or, to that of the cow, barley straw or clover, which are rich in salts of lime, the health of the animal is sustained.*

Men and animals receive their blood and the principles of their bodies from the vegetable kingdom, and an inscrutable wisdom has ordained that the life and the vegetation of the plant should be connected by the closest links with the absorption of the same mineral substances that are indispensable to the animal organism. Without those inorganic matters which we know to be principles of their ashes, it is impossible to form an idea concerning the formation of the germ, of the leaf, of the flower and of the fruit.

The quantity of the principles serving for the nourishment of animals is extremely unequal in the cultivated plants.

There is a much greater relation between tubercles and roots, with respect to their chemical principles, than with the seeds. The latter have always a similar composition.

Potatoes, for example, contain from 75 to 77 per cent. of water, and from 23 to 25 per cent. of solid substance. By means of a mechanical operation, we can decompose the latter into 18 or 19 parts of starch, and and three or four parts of dry, amylaceous fibre. It is easy to see that the two combined weigh almost as much as the dry potatoes themselves. The two hundredths which are wanting are formed of salts, and of the sulphuro-nitrogenous substance known under the name of albumen.

Beet roots contain from 88 to 90 per cent. of water. 25 parts of beet roots contain, very nearly, the same elements as 25 parts of dried potatoes. We found from 18 to 19 parts of sugar, and 3 or 4 parts of cellular tissue; half of the two hundredths which are wanting is formed of salts; the rest is albumen.

Turnips contain from 90 to 92 parts of water. From 23 to 25 parts of dry turnips contain from 18 to 19 parts of pectine, with very little sugar, three or four parts of cellular tissue, and two parts of salts and albumen. Sugar, starch, and pectine contain no nitrogen; they are met with, in plants, in the free state, never in that of combination with salts or alkaline bases. These are combinations formed by the carbon of the carbonic acid, and the principles of water, whose elements take the form of starch in the potato, that of sugar in the beet-root, and that of pectine in the turnip.

We have as a sulphuro-nitrogenous principle, in the seeds of cereals, *vegetable fibrin;* in peas, beans and lentils, *caseïn;* in the seeds of oleaginous plants, *albumen* and a substance greatly resembling caseïn.

The vegetable fibrin of the seeds of cereals is accompanied by starch. This same body is a principle of the pods of leguminous plants. In the oleaginous seeds the starch is replaced by another nitrogenous principle, analogous to oil, butter, or wax.

It is evident, that, according to the object of culture, and according to the principles which we wish to obtain, we should present to plants, the conditions necessary for their production. Sugar and starch require the

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* The workmen, in the mines of South America, whose daily work (perhaps the hardest in the world) consists in raising on their shoulders, from a depth of 146m. 178, a charge from the mine of the weight of from 90 to 100 kil., live only on bread and beans; they would prefer bread alone for their nourishment; but their masters, who have found that they cannot work so hard with bread alone, treat them like horses, and force them to eat beans (Darwin, *Journal of Researches*, p. 321). But beans contain proportionally, much more of the earthy substance of the bones than bread.

addition of other substances than the sulphuro-nitrogenous principles.

To furnish to the potato and the beet-root the necessary principles of their leaves, that is to say, organs destined for the absorption and assimilation of carbonic acid, is to fulfil the conditions of the formation of starch and sugar.

The juice of all vegetables rich in sugar and starch, and most of the ligneous plants, is rich in potassa, soda, or the alkaline earths. These alkalis and alkaline earths cannot be considered as accidental principles; we must suppose that they answer certain objects in the organism of the plant, and that they are absolutely necessary for the formation of certain combinations. I have said that they are combined in plants with organic acids which characterise some kinds of vegetables, so that they are never wanting. The organic acids themselves should be the inter-media of certain vital functions in the organism of the plant. Now, if it be borne in mind, that fruits, before arriving at maturity, grapes for example, are not eatable on account of their great quantity of acid, that these fruit act absolutely like leaves in the solar light, endowed, as they are, with the power of absorbing carbonic acid, and of eliminating oxygen (De Saussure); that the augmentation of the sugar coincides with the diminution of the acid, we can scarcely help thinking that the carbon of the organic acid in the fruit, before its maturity, becomes a principle of sugar in the ripe fruit, that it is thus, by an elimination of oxygen, with an assimilation of the elements of water, that the acid is converted into sugar.

The tartaric acid in grapes, the citric acid in cherries and gooseberries, and the malic acid in summer apples which ripen on the trees, are, therefore, the inter-media of the conversion of carbonic acid into sugar; deprived of the proper temperature, and of the action of the solar light, they would not undergo the changes of this metamorphosis.

Now, we see in the sorb apple of bird-catchers *(sorbier des oiseleurs)* the tartaric acid replaced by malic acid, the more oxygenous acid by the acid containing less oxygen; we see the malic acid gradually almost completely disappear from these fruits, and we find in its place gum and mucilage which did not previously exist in them, and, consequently, we have reason to admit the conversion of the carbon of the tartaric acid into that principle of malic acid which succeeds to it, a transformation not easily involved in doubt, as much as we have to attribute it to the metamorphosis of those acids into sugar.

The opinion that a plant assimilates carbonic acid, that this carbonic acid takes in its organism the forms of tartaric, racemic, and citric acids, only to be finally converted into carbonic acid; this opinion, I say, cannot be reasonably sustained.

If this mode of view relative to the part which organic acids take in the formation of sugar be confirmed, it should have the same value relative to the formation of all the other non-nitrogenous substances of similar composition; the formation of starch, pectine, and gum, is not, therefore, immediately produced, without transition, by the carbon of the carbonic acid, and the elements of water; but a gradual transformation is operated in consequence of the production of combinations which become, by degrees, more poor in oxygen, and richer in hydrogen. The formation of oil of turpentine cannot be represented without the production of analogous intermediate bodies.

But if the organic combinations, rich in oxygen, *the acids*, are the inter-media of the production of those which contain less oxygen, sugar, starch, &c., it is clear, that in cultivated plants, in which the acids are rarely in the free state, but in which they ordinarily exist under the form of salts, the alkalis and the alkaline bases should be regarded as the conditions of the production of the non-nitrogenous principles. Without the presence of these bases, an organic acid may, perhaps, be formed; but, without the acid, neither sugar, starch, gum, nor pectine, can be formed in the organism of these plants. In the fruits and seeds, in which the organic acids are free, that is to say, not in the state of salts, such as citric acid in lemons, oxalic acid in chick-peas, sugar is not formed. Sugar, gum and starch, are produced only in the plants in which the acids are found combined with bases, which are met with in plants.

Whatever may be the value which may be accorded to this opinion concerning the part performed by alkaline bases in the vital act of vegetables, the positive fact that, in young shoots, the leaves and buds which are developed, consequently in the parts of the plants in which the faculty of assimilation is observed in its greatest force, the proportion of alkaline bases is most considerable, that the vegetables most rich in starch are not less distinguished by their richness in alkaline bases, and in organic acids; this observation, I say, cannot, on account of this view, lose its value in rural economy.

If we find sugar and starch accompanied by salts, formed by organic acids, and if experience demonstrates that, without alkaline bases, all the development of the plant, the formation of sugar, of starch, and of ligneous fibre, are found restrained; that their presence gives activity to, and augments, its

vegetation, it is clear that if in culture a maximum of product should be attained, it is not by an excess of carbonic acid and humus that it can be effected, if we do not present to the plants, in great quantity, and in a state appropriate to absorption, the alkalis which are the principal conditions of the conversion of carbonic acid into sugar and starch, whatever may be the manner in which they may contribute to this result.

The oxalic, tartaric, citric and malic acids, &c., are produced in the organism of the plant: their carbon arises from carbonic acid.

We find, in vegetables, these acids combined with potassa, lime and magnesia, in the state of salts, the smallest parcels of which, abandoned to themselves, follow their own attractions, as is seen in their tendency to crystallize.

It cannot be doubted that these combinations do not possess the character of organic life, precisely because the force which appears to be in activity in them is not the vital force, but the force of cohesion. It must be quite the same with sugar, which is, likewise, crystallizable.

We should suppose that the smallest parcels of the products, whose formation is due to carbonic acid, are subordinate to the activity which, in the living plant, reacts on them, like the smallest parcels of carbonic acid itself; that, thus, the carbon of the oxalic and tartaric acids, &c., should possess the faculty of becoming the principle of an organ endowed with vital force.

It is easy to pursue this metamorphosis in the organic acids. If we represent 12 equivalents of our carbonic acid as losing (in presence of a base, and under the influence of light, in consequence of the action of the vital force of its elements), the fourth of its oxygen, we have oxalic acid. This acid may be imagined in the anhydrous state, by supposing that the carbonic acid has not given rise to it in any other manner:—

$C^{12}O^{24} - O^6 = C^{12}O^{18}$ = 6 eq. of anhydrous oxalic acid.

The oxalic acid does not exist in the anhydrous state. In the state of hydrated oxalic acid, it contains 1 eq. of water; the salts of potassa, lime, and magnesia, likewise contain water. Hydrated oxalic acid is formed of:—

$C^{12}O^{18}$ + 6 eq. = $C^{12}H^6O^{24}$ = 6 eq. of hydrated oxalic acid.

It is easy to observe that carbonic acid and hydrated oxalic acid contain an equal quantity of oxygen. We may, therefore, here represent hydrated oxalic acid as carbonic acid, into the composition of which a certain quantity of hydrogen enters.

If the continuation of the influence of the activities eliminates from oxalic acid fresh portions of oxygen, we have tartaric or malic acid. Tartaric acid is formed by the elimination of 9 equivalents of oxygen: the separation of 12 equivalents of the same element gives rise to malic acid.

Hydrated oxalic acid $C^{12}H^6O^{24} - O^9$ = 3 eq. of tartaric acid.
,, ,, $C^{12}H^6O^{24} - O^{12}$ = 3 eq. of malic acid.

It is by a simple separation of water from the elements of malic acid that citric acid is formed; we know, that, by the sole influence of heat, we can produce, with citric acid, *aconitic acid*, and with malic acid *lichenic* and *maleïc acids*.

Malic acid $C^{12}H^6O^{12} - Aq = C^{12}H^5O^{11}$ = 3 eq. of citric acid.
,, $C^{12}H^6O^{12} - 3\,Aq = C^{12}H^3O^9$ = 3 eq. of lichenic acid.

We may now consider the tartaric and malic acids as combinations of oxalic acid with sugar, gum, ligneous fibre, or their elements.

Tartaric acid.		Oxalic acid.		Dry grape sugar.
$2\,(C^{12}H^6O^{15})$	=	$C^{12}O^{18}$	+	$C^{12}H^{12}O^{12}$

So that, consequently, by the addition of new quantities of hydrogen, all these acids may contribute to the formation of sugar, starch and gum. In this metamorphosis, the alkalis, which were combined with the acids, should, as is self-evident, be set at liberty; they should recover the faculty of again performing the same parts. It may, therefore, be believed that one equivalent of alkali may serve for converting 10, 20, and even 100 equivalents of carbon into a principle of the plant. It is by time alone that the quantity of the base present produces any difference.

If a living evergreen plant assimilates, throughout the year, with the assistance of a given quantity of potassa, a certain quantity of carbon under any form whatever, a summer plant requires nearly four times as much potassa to assimilate the same quantity in one-fourth the time.

Gay-Lussac first observed that oxalic,

tartaric and citric acids, and sugar, ligneous fibres, &c., are brought to the state of carbonic acid by the contact of an alkali, at a high temperature.

This course of decomposition is precisely the inverse of that which occurs in plants. In the latter, the elements of water are added to the combination of carbon to the carbonic acid, oxalic and tartaric acids, &c., are formed, *owing to a separation of oxygen*,

In the chemical operation indicated, the elements of water in presence are added to those of the oxalic and tartaric acids, &c.; they are brought to the state of carbonic acid *by a separation of hydrogen.*

Without disengagement of any gas, from the fact of the presence of an alkali, the tartaric and citric acids are already divided, at a at a temperature of 392° F., into oxalic and acetic acids. But the anhydrous acetic acid contains carbon and the elements of water precisely in the same relative proportion as ligneous fibre (Peligot) which, in perfectly similar conditions, also gives acetic acid.

This mode of decomposition has led a distinguished French chemist to admit the existence of oxalic acid ready formed in tartaric acid. At all events, its elements are formed in it by the side of a second body, which, like sugar, gum and ligneous fibre, may be regarded as a combination of carbon with water.

Every part, every principle, of the animal body is derived from plants. It is by the organism of plants that the combinations which serve to sanguification are formed; it cannot be doubted that the parts of the plants serving as food contain, not only one or two, but all the principles of the blood.

(To be continued.)

ON THE MODES OF ASCERTAINING THE VALUE OF ARTICLES OF COMMERCE, AND, MORE ESPECIALLY, OF THE ALKALIS, ACIDS, ORES OF MANGANESE, &c.

BY CHARLES WATT, JUN.

I INTEND next month to commence a series of articles on the analysis of those substances sold in commerce, whose commercial value is always determined by analysis.

I shall, in the first place, enter upon the subject of Alkalimetry, discussing the various methods in use for ascertaining the amount per cent. of real alkali contained in the soda-ash and pearl-ash of commerce, showing the objections to some of the processes which have been *proposed*, and to those which are *practised*, for the accomplishment of this object; and I shall subsequently enter into the consideration of Acidimetry, the assaying of the ores of manganese, &c., &c.

In doing so, it is my hope that this subject will prove not uninteresting to the readers of THE CHEMIST: it is fraught with importance to every commercial and manufacturing country, and, perhaps, to England more especially.

I may here observe that the state of what may be called *commercial chemistry* is lamentable indeed; I do not mean to assert that there are *no* good methods of ascertaining the commercial value of articles, although it is too true that this important branch of chemical science has not been sufficiently cultivated, because its value and the results of which it is capable have not been properly estimated by those whom it most deeply concerns — the importers, dealers, manufacturers, purchasers, &c. How often are these analyses confided to the unskilful hands of men "known in the market," but who are complete strangers to science! It is a most extraordinary fact, that the most implicit reliance is placed in the assays and analyses of such persons, and that they are taken as law and gospel from *them*, when from a true man of science they would probably be doubted.

These observations are made from very extensive personal experience, and are intended merely to awaken proper attention in the minds of those whom these subjects concern, and to prove to them the necessity for great circumspection as to the persons in whom they confide.

It is of the highest importance that every method of ascertaining the commercial value of articles, placed in the hands of the public, should be simple, and that its results should be worthy of dependance; and it is the legitimate occupation of every chemist who has commercial welfare at heart, when opportunity occurs, to review them and to point out their sources of inaccuracy, if they have any, and thus to render himself, so far as in his power lies, a guardian over the interests of those connected with these subjects, to whom they may safely look for information without the fear of being misled by his ignorance, or purposely misguided from his own views of gain.

It may be right here to add, that, in the analyses of articles of commerce, much depends on the care with which the samples are taken from the bulk, and much of the want of agreement in results is to be attributed to this source. It is the duty of those who perform this office never to omit any precaution which may tend to insure uniformity in this respect. I shall hereafter

have occasion to return more especially to this part of the subject.

Chemical science is progressive; that which yesterday was apparently as perfect as circumstances would admit of, or, I might almost add, as was desirable, to-day is inadmissible, and perhaps at the arrival of a comparative to-morrow will be entirely expunged from memory, or remembered merely as a dream.

OBSERVATIONS RELATIVE TO THE REMOVAL OF THE DUTY ON SPIRIT OF WINE TO BE USED FOR MANUFACTURING PURPOSES.

BY JOHN WATT.

It has long been my intention to lay before the readers of this work some reasons why the duty should be taken off alcohol to be used for manufacturing purposes, as soon as it is rendered unfit for the purposes of drink. My attention has recently been more particularly called to the subject by my friend Dr. M. Rosenthal, to whose kindness I have, on many occasions, been indebted for valuable information and assistance.

It was my desire to have commenced my observations this month, but, owing to some disappointment in obtaining certain intelligence, I am quite unexpectedly and unavoidably compelled to defer them until next number.

LARD OIL,* &c.

The subject of the manufacture of oil from corn and lard was introduced to the notice of the public in the report of last year. As corn oil has heretofore been connected with distillation, although it is easily made and answers a good purpose, less attention has been devoted to it. It has been suggested, on good authority, that it can be gathered from the mash which is prepared for fermentation for feeding swine. If this should be confirmed by further experiments, as it would not be liable to the same objection urged against the former, the manufacture of spirituous liquors, it may, hereafter, be carried on to a great extent. No doubt seems to be entertained of its value for burning, and all other purposes to which oil is applied, but painting.

Much interest has been felt on the subject of oil from lard, and the almost daily inquiries respecting its process of manufacture, &c., and its connection with the question of disposing of our agricultural products, forms a reason for giving it a more extended consideration in these remarks. Complete success has attended the enterprise. Several large factories for the manufacture of this oil have been some time in operation in Cincinnati, and thousands of gallons are daily prepared for home consumption and exportation. It is also carried on at Cleveland, Ohio; Chicago, Illinois; Burlington, Iowa; Hannibal, Missouri, and other places both in the Western and the Atlantic States.

It is considered much superior to olive or sperm oil for machinery, and for the manufacture of woollens, &c. It can be furnished also at half the price, and, therefore, it will, doubtless, supersede that article of import. As it contains less gelatine than other oils, it is found much better for combing wool, for which purpose a single factory wished to contract for 10,000 gallons from one establishment. It is also undergoing trial in England; and if it succeeds, of which there can be scarcely a doubt, large orders for it may be expected, or, at least, the American lard itself, which pays a less duty, will find a ready market. An order for 600 gallons, with this view has already been received for the use of a cloth factory in Huddersfield, England. It has also been stated in the journals that a gentleman is about taking out a large quantity, recently ordered from the West, for the purpose of trying it there as an article of trade; and it has lately been stated that 16,000 bbls have been sent from Cincinnati to England. Repeated experiments, too, have shown, that, for the purpose of combustion, no oil is superior. It is important, in trying it with this view, to obtain a good article, manufactured from good lard, and not from the dark-burned, which creates smoke, and clogs the flame. For want of sufficient care in this respect, some have, no doubt, met with disappointment in their attempts to substitute this oil for sperm oil in the lamps.

Oil is, likewise, made of the sun-flower—thirty-five gallons to an acre. The cultivation of the castor bean continues to be carried on with increasing success for the manufacture of castor oil, which may also be turned into stearine and oil for burning. A single firm in St. Louis has worked up 18,500 bushels of beans in four months, producing 17,750 gallons of oil, and it is stated that 800 barrels have been sold at fifty dollars the barrel. This oil likewise admits of being prepared for machinery, soap, &c., and it is much more soluble in alcohol than lard. A new experiment, too, as to the introduction of rape seed for the same purpose, promises much success, as it

* *United States Report*, and *Illustrated Polytechnic Review*.

is found that rich ground will produce from twenty-five to forty bushels to the acre. Ten quarts of oil may be obtained from a bushel of seed. Oil cake is worth, per bushel, about the same as oats. This oil sells for from seventy-five cents to one dollar the gallon.

DISCOVERY OF A SUBSTITUTE FOR INDIGO.

A Calcutta correspondent writes to the *Morning Post*, stating that a *vegetable black dye* has been discovered, which will entirely supersede the "use of indigo in all colors of that description, and, in point of cost, certainly at a tenth of the price." This substance was pronounced by one of the scientific members of the Agri-Horticultural Society of Calcutta to be "a most valuable production—a discovery of an original and genuine 'black vegetable dye.'"

The correspondent of the *Morning Post* is preparing for the press a "full account," for which we shall be on the look out, with the view of laying the whole matter before our readers.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

PHARMACEUTICAL SOCIETY.

Mercury dissolved in lard!—Dr. Thomson in 1837; Dr. Thomson in 1843; Mr. Redwood and Mr. Mowbray on the solubility of sulphate of potassa.

We were present at a meeting of the above society, held at No. 17, Bloomsbury-square, on Wednesday evening, December 13, 1843. Mr. Payne, Vice-President, in the chair.

After a few observations from the Chairman in the most elegant and correct English, the purport of which was quite above our humble comprehension,

A paper, by Mr. Dallas, on the division of mercury by fatty matters, was read, in which the author gave it as his opinion that the *mercury in the* ung hydrarg. *exists in a state of solution*; and (credat Judœus) the reasons on which this supposition was founded, were:—

"That considering the *atomic weights* of mercury and lard, the proportion of the latter, even in an *oxidised* state, was insufficient to furnish the oxygen to the metal in order to convert it into an oxide."

That the author had read somewhere, that, when the ointment was exposed to a cold temperature, metallic globules had been observed to separate, thus proving that it was *dissolved* in mercurial ointment at ordinary temperatures.

Will it be believed that such a misapplication of the atomic theory has been approved of by the "Council" of the Society as this of Mr. Dallas; or, are the members unaware of the existence of oxygen in the atmosphere?

It is necessary for us to state that not one single attempt has been made by Mr. Dallas to *ascertain* the state in which the mercury actually exists; his object appears to have been merely to obtain credit for having perused half a dozen lines of Pereira's *Elements of Materia Medica and Therapeutics*.

Mr. Mowbray, having premised that it was always dangerous for the pharmaceutist to give a medical opinion, would still observe that an eminent author had stated that an ointment made with the protoxide of mercury had not been found so efficacious as the ointment made with metallic mercury in the ordinary manner; for that, with the former, the lard was absorbed, and the oxide left on the surface of the skin, and salivation had not been observed to follow, whilst, with the latter, the metal became absorbed and the usual effects of mercury upon the system supervened.

Dr. A. T. Thomson, begged to inquire of the gentleman who had last addressed them, whence he had derived the information on which such a statement was based? who was present when such an experiment was made? and whom could he give for an authority? for that he (Dr. T.) had *tried* an ointment made with the *oxide*, and found it *quite as efficacious* as the ordinary blue ointment.

Mr. Mowbray would not venture to assert the name of his authority at that moment: his information was derived from one of two works, however; an extract contained in the *Pharmaceutical Journal*, or, it might have been from Berzelius; in one of those

works the substance of what he had stated would be found.

Dr. A. T. Thomson was very much inclined to doubt any such authority. Berzelius was a good chemist, but no authority in matters relating to the healing art; and from his own experience he should like to know who was present and how the oxide had been prepared;* *well* prepared, he could *vouch* for the oxide having been *duly absorbed*, in opposition to the announcement by Mr. Mowbray.

The next paper was by Mr. Mowbray, wherein he very ably discussed the following views of Mr. Redwood, who has stated:—

I. That sulphate of potassa *is more soluble* in carbonate of soda than in distilled water.

II. That sulphate of potassa *is not more soluble*, but that it is *partly* decomposed on the addition of carbonate soda, into sulphate of soda, and carbonate of potassa.

III. That, *in powder*, it dissolves in the proportions of 1 part of the salt to 9·5 parts of water, but that *the crystals* require 16 parts of water for their solution.

Mr. Mowbray having tested some of the salt *obtained from* Mr. Redwood, found it to yield a precipitate with both oxalate of ammonia and oxalate of potassa, and concluded therefrom, as well as from experiments tried with a pure salt, that it contained lime.

Mr. Redwood, feeling if we might form an opinion from his *energy*, that his position as lecturer was in danger, termed the precipitate obtained by Mr. Mowbray, "*homœpathic*"!! and having procured the assistance of Dr. Ure and Mr. Fownes, had prepared beforehand some solution, but what it was, those present had no opportunity of ascertaining; doubtless, it contained no lime; to this he applied the test of oxalate of ammonia, which did not give a precipitate.

Dr. Ure then delivered himself of some common-place remarks on chemical testing, tending to show that it was the most difficult art possible, next complimented himself on his skill as a microscopic chemist, and Mr. Mowbray as being well versed in chemistry; this done, he was followed by Mr. Fownes, who having in the course of Mr. Redwood's delivery sadly embarrassed that gentleman by certain well meant suggestions, now attempted a translation of Gmelin's Chemistry, which had been lying on the table; but Mr. Fownes will appreciate our motives in reporting his efforts when he *assumes* the position of a chemist, rather than describe his first appearance as a would-be German linguist.

Our impression is that the views of Mr. Redwood are too obscure for himself to understand; or, perhaps, he seeks to earn an ephemeral popularity by attempt to controvert received opinions in chemistry upon data most miserably insufficient for the purpose.

Mr. Redwood's paper was, we believe, published in the December number of that curious *mélange*, the *Pharmaceutical Journal*, and we think, that, in justice to Mr. Mowbray, his views should also be published in that work, although we have no doubt that he is not very desirous of such an honor being conferred on him; and as commercial sulphate of potassa is cheap, we recommend Mr. Dallas to venture upon one experiment, now that he has delivered himself of theory, yclept "the solution of mercury in axung." as he elegantly termed it; or would the Dr. Thomson of 1843 obtain some respectable *witnesses*, and equally respectable tests, in order to set the point at rest?

And now we can estimate the amount of metal in pharmaceutical great guns; we recommend every associate to attend the meetings of the Pharmaceutical Society; self-complacency and self-supposed qualification are no where so luxuriant.

* For Dr. A. T. Thomson's information we have referred to the *Pharmaceutical Journal*, Vol. I., p. 197, line 22, professing to be an extract from the Dispensatory, edition 1837, where the learnrd, but short-memoried, author is thus quoted:—

"Ungventum Oxidi Hydrargyri Cinerei. (*Dr. A. T. Thomson's Dispensatory*, 1837.) As the whole of the mercury in this ointment is oxidized, it might, *à priori*, be supposed that it would answer all the purposes of the mercurial ointment; but it cannot be so easily introduced by friction, the oxide remaining on the surface of the article, after the unctuous matter is absorbed."!!!

Which Dr. Thomson are we to believe, then—the author of the Dispensatory of 1837, or the lecturer to the Pharmaceutical Society of 1843?

ON OINTMENTS AND WAX.

BY M. DESCHAMPS.

(Concluded from No. XLVIII, p. 551.)

SECOND PART.—ON WAX.

I had remarked that the cerate prepared with the commercial wax of Paris, could not be employed for the preparation of the ointment of iodide of potassium, because it contained an acid which decomposed the

* *Journal de Pharmacie.*

iodide, whilst the cerate prepared with wax bleached at Bourbonne-les-Bains had no action, at least immediately, on this iodide. I at first thought that the wax which I had obtained, notwithstanding its apparent good quality, was adulterated, and I distilled a certain quantity of it: not finding sebacic acid in the products of the distillation, I thought that the wax chandlers had arrived at successfully employing the acids in bleaching wax, and that the wax retained a certain quantity of the acid employed, or that an acid was formed under the oxidizing influence of the body employed for bleaching, or for preparing wax to be bleached.

Boiling water not being capable of removing this acid, I investigated the action of nitric acid and that of potassa and wax, and I endeavored to isolate the acid contained in the commercial wax of Paris.

I had been for some time occupied with these investigations, when some distinguished chemists announced that they had obtained several new acids by causing nitric acid to act on wax. From that time I endeavored to isolate the bodies which had not been noticed; and I will now describe, as the first part of my work, their preparation, reserving for a second memoir, the analysis of the bodies which are formed under the oxidizing influence of nitric acid, and of potassa on wax, and the analysis of the acids contained in the commercial white wax of Paris.

If 50 grammes of yellow wax (white wax, cerin, and myricin may be employed) be introduced into a retort with 125 grammes of nitric acid at 40°, and 125 gr. of water (the acid may be employed alone), if the mixture be distilled until little or no acid remains in the retort, if the residue be washed with boiling water, and filtered when cold, a yellow liquid is obtained which, evaporated, gives a residue from which an acid, resembling suberic acid may easily be extracted. If, after this first operation, 320 gr. of nitric acid be poured into the retort, at 3 times, and if it be cautiously distilled, the product of the distillation being collected, an oleaginous liquid remains in the retort, and a very acid liquor is obtained in the flask. If the liquid of the flask be distilled, we find that the receiver is greasy, and that it contains a greenish-yellow liquid, covered with an oily layer which gives out a strong odor of butyric acid. If it be saturated with potassa, evaporated, treated by cold alcohol at 90°, and if it be evaporated, after filtration, a colored salt is obtained which contains butyric acid and an oily, volatile fatty acid; if some of this salt be put into a retort with alcohol and sulphuric acid, an ethereal liquid is obtained which gives off the odor of butyric acid.

It was by continuing the action of nitric acid on altered wax (and it requires much acid) that MM. Ronalds and Gerhardt obtained azoleïc pimelic, adipic, lipic and succinic acid, I would only observe that succinic acid may be obtained before the disappearance of nitrous vapors, for it is sufficient to evaporate the acid liquor in such a manner as to make it crystallize in the retort, to remark the height of the liquid at the moment of crystallization, and to evaporate daily to the same height. When the crystals appear to be composed of small prisms, the mother liquor must be decanted, and the crystals must be washed and several times re-crystallized in order to obtain very fine crystals of succinic acid. If, instead of adding nitric acid to the altered wax, boiling water be poured into it, a thick and very oily fatty body is obtained, which may be separated by filtering the liquid through a moistened double filter, the oily body remains in the filter. By evaporating the liquid, adding water, an additional quantity of this fatty body is obtained.

ACTION OF POTASSA ON WAX.

I put 30 gr. of yellow wax, 60 gr. of caustic potassa, and 10 gr. of water into an iron ladle; I heated it over a good fire until the matter became very hard by cooling; I allowed it to cool, and treated it by sulphuric acid: carbonic acid was disengaged, and a butyric odor was given off. I filtered, then I saturated the liquid with potassa, I evaporated it, treated it by cold alcohol, and I obtained, after evaporation, a small quantity of a salt containing butyric acid. The wax, after the first action of potassa, was not very soluble in the alkaline water. I again treated it with 30 gr. of potassa, and obtained a matter almost soluble in water. I decomposed the soap with sulphuric acid, washed the product, which was of a dirty grey, with boiling water, treated it with boiling alcohol at 90°, and filtered the solution. There remained on the filter only a very small quantity of fatty matter, from which I was able to extract, by means of potassa, a little ulmic acid. The alcoholic solution deposited a floculent matter, which I collected on a filter and dried.

The alcohol was distilled, and left a yellowish matter, having a consistency analogous to that of wax; I saponified it, separated the soap with a solution of common salt, and repeated these operations several times. I dissolved the soap in water, diluted the solution with a great quantity of water, and it deposited an opalescent matter, which, after desiccation, was treated by boiling alcohol at 90°. The solution was filtered and evaporated, and the bisalt was decomposed by

hydrochloric acid. This fatty body fuses at 138° F., and solidifies at 129° F., with a crystalline appearance. The liquid which deposited the bisalt contained an acid evident at 107° F., and solidified at 100 °F. : it is a mixture.

The dried floculent matter was saponified, then diluted with a large quantity of water; the liquid became opalescent and did not deposit anything. I filtered this soap and decomposed it by nitrate of baryta, washed the insoluble soap, dried it and treated it by boiling alcohol at 90°. This alcohol took up only a very small quantity of barytic salt. The insoluble part was decomposed by sulphuric acid, washed with boiling water, treated with boiling alcohol at 90°, and the solution was filtered ; after cooling, I filtered to collect that which was deposited, and I dried it. This body, precipitated from the alcohol, is floculent and agglomerated, and is readily pulverised between the fingers; when fused,it is hard and brittle, and does not crytallize : it fuses at 183° F., and solidifies at 170° F., I treated it by feebly alkaline water ; the liquor became milky, and I filtered it through a previously moistened double filter : the liquor passed through clear, and contained little or nothing. There remained on the filter a gelatinous white matter, similar to albumen in jelly. This jelly was heated in water ; it formed an opalescent mass, and it floated on the surface of the liquid only when I added a little acid.

What makes me believe in the entire saponification of this matter is, that under the influence of potassa it swells up, becomes transparent and gives to the boiling liquid, especially with a slight excess of potassa, the appearance of very thick mucilage. When the mucilage is diluted with water, and when the liquid is filtered through a single filter, everything passes through, and the liquor is opaque.

EXTRACTION OF THE ACID CONTAINED IN THE COMMERCIAL WHITE WAX OF PARIS.

I treated 250 gr. of white wax by boiling alcohol at 90°, until the wax ceased to color a solution of iodide of potassium ; I distilled the alcohol, and I obtained a very acid fatty body, of a soft consistenee, of a yellowish color, and of the well-characterised odor of wax. This matter, which weighed 96 gr. was saponified with 8 gr. of potassa *(à l'alcohol)* ; I decomposed the soap by acetate of lead, washed the precipitate, dried it and treated it by boiling alcohol at 90°, until, by cooling, the alcohol allowed nothing to deposit. By this alcoholic treatment I separated the preparation of lead into three parts, the first, soluble in boiling alcohol and insoluble in cold ; the second, soluble in cold alcohol ; and the third, insoluble in boiling alcohol. I studied only the first two, because the third was in too small quantity. I treated the first several times by ether, at the ordinary temperature ; I decomposed the soap of lead, insoluble in ether, by hydrochloric acid, washed the fatty body with boiling water, until the liquid had no longer any action on litmus paper; I dissolved it in alcohol and filtered it. On cooling, a floculent matter was deposited, which was collected on a filter and dried.

The alcohol, which had deposited the floculent matter by cooling, gave by evaporation a yellowish matter, rather softer than wax. I saponified it, and diluted the solution with a large quantity of water ; an opalescent matter separated, which was washed and treated by boiling alcohol. I filtered the solution and decomposed it by hydrochloric acid. This fatty body fuses between 136° and 138° F., and solidifies betwhen 127° and 129° F., with a crystalline appearance.

The floculent matter, after desiccation, was white, agglomerated, easily pulverised between the fingers ; spread on paper with a hard body it glazed it, and the paper was smooth to the touch. I saponified it, treated it in the same manner as the unsaponifiable matter obtained by treating wax by potassa, and it acted in the same manner ; there is no difference in the point of fusion.

The second part of the soap of lead, that is to say, that which remains in solution in the alcohol, was treated by hydrochloric acid, saponified, treated by common salt, decomposed by an acid, washed in boiling water and dissolved in cold alcohol. The solution, filtered and evaporated, left a thick, oily and very acid liquid, having the odor of wax and the color of linseed oil.

From the facts contained in this memoir, it results :—

That during the oxidation of wax by nitric suberic, butyric, azoleïc, pimelic, adipic, lipic, and succinic acids, a volatile and a non-volatile oily acid, are formed :

That by treating yellow wax by potassa, butyric, ulmic and margaric acids, and an oily acid, are formed, since the liquid which yielded the margaric acid contains a soft, fatty body, fusible at 107° F., and a body remains which is not saponifiable :

That the commercial wax of Paris is acid :

That it owes its acidity to an oily acid, and to margaric acid :

That these acids may be entirely extracted from wax by means of alcohol :

That these acids appear to me to be the result of an alteration of wax, which altera-

tion is caused by the preparations to which the wax-chandler subjects wax which he is about to bleach, because these products greatly resemble those obtained by causing potassa to act on wax, because, if this wax contained tallow, I should have found sebacic acid in the product of its distillation, and because, if stearic acid had been added, I should have found it:

That it is very probable that some wax-chandlers of Paris accelerate the bleaching of wax by treating it at first with an alkaline liquor:

That the cerate should be preferred for making desiccative ointment, because the wax which enters into its composition is not absorbed like the other fatty bodies, and because it forms on the surface of wounds a waxen layer, which protects the nascent epidermoïd membrane.

ON SANTONINE.*

BY M. MIALHE.

Santonine is a principle *sui generis*, to a certain extent resembling the concrete volatile oils, or stearoptens, discovered at about the same period by Kahler and Alma, and studied by Trommsdorff, junior. It exists in several species of the genus *Artemisia*, and especially in those which produce the flowered summits designated in commerce under the name of semen-contra.

The chemical properties of this substance are very remarkable: it is presented in brilliant crystals, which are elongated quadrilateral tables; it is colorless and almost tasteless, which is owing to its sparing solubility in water, this vehicle dissolving, when cold, only $\frac{1}{5000}$ of its weight; a proof of this is that its alcoholic solution presents a very distinct bitter taste.

Santonine is neutral to test-papers; however, it can combine with bases in the manner of acids, forming salts, several of which are soluble and crystallizable.

Are the eminently vermifuge properties of semen-contra due to santonine, or to the volatile oil which this substance contains?

Santonine has, it is said, very powerful vermifuge properties in the dose of 30 or 40 *centigrammes*. But, according to M. Soubeiran, this property belongs more certainly still to the essential oil of semen-contra. According to M. Calloud, sen. (d'Annecy), to whose kindness I owe the following information, santonine is specifically poisonous to lumbricæ. This distinguished *pharmacien* has administered it to hundreds of children, with such success that the results far exceeded his anticipations.

M. Calloud affirms, moreover, that having distributed this substance to a great number of colleagues, physicians and fathers of families, all of whom, with one accord, have acknowledged its good effects.

If the assertions of my esteemed *confrère* be not exaggerated, santonine constitutes, without doubt, a medicinal agent calculated to render real services to the therapeutics of children: being almost tasteless, it will be generally preferred to the volatile oil of semen-contra, whose bitterness is such that few children can take it.

But, it will be asked, since this stearopten has no marked taste, and since it is almost insoluble in water, how is it that it has so decided a poisonous action on lumbricæ?

Nothing is more easy than to reply to this question: santonine is, it is true, very sparingly soluble in water, but it may be dissolved in it in all proportions by means of the alkalis; now, the liquid contained in the portion of the intestinal tube where the parasites in question are ordinarily located, presents a very evident alkaline reaction, which makes it capable of rendering this substance soluble, and consequently bitter and active.

I may also remark that the property which santonine possesses of being soluble and absorbable only in the inferior part of the alimentary canal, renders its efficacy certain. Moreover, every good anthelmintic should necessarily belong to the class of bodies which are only sparingly or not at all soluble in the stomach. For example, if it be wished to know why a few centigrammes of calomel constitute a vermifuge incomparably more certain in its effects than a quantity of corrosive sublimate equal to that which results from the partial transformation of the protochloride of mercury into bichloride under the influence of the alkaline chlorides which our fluids contain, it is because a small dose of corrosive sublimate in nature is absorbed in the *primæ viæ*, whilst the partial conversion of calomel into sublimate takes place in all parts of the digestive tube, which allows of the poison reaching the intestinal worms in whatever part of the canal they may be.

Although santonine has so little taste that many chemists regard it as insipid, nevertheless M. Calloud has remarked that it must be associated with 40 or 44 parts of sugar, in order that children may be easily made to take it. The following appears to him the most convenient formula:—

* *Bulletin de Thérapeutique.*

SANTONINE LOZENGES.

℞ Powdered santonine .... 4 grammes.
Powdered white sugar .. 150 ,,
Powdered gum tragacouth 2 ,,
F. ℔ A. 144 lozenges.

M. Calloud has omitted to mention the number of these lozenges to be administered to children, but this omission may readily be rectified by calling to mind that the dose in which it is proper to prescribe santonine is from 30 to 50 centigrammes *per diem*, and that each lozenge contains 2½ centigrammes of active matter.

EXTRACTION OF SANTONINE.

M. Calloud having put in practice the various processes hitherto pointed out for obtaining santonine, has been led to adopt the following, which is partly his own :—

Thirty kilogrammes of semen-contra are placed in a large boiler with a sufficient quantity of water, and heated ; when boiling, milk of lime is added, in sufficient quantity to saturate the santonine, and at the same time to fix the greater part of the coloring matter. The product is then pressed, and the residue replaced in the boiler, where it is exhausted by a fresh portion of warm water, it is again pressed, the decoctions are mixed, allowed to deposit, decanted, evaporated in a large basin, and, at a certain degree of concentration, it is clarified and strained through flannel. This done, the liquor is replaced on the fire, and again suitably evaporated ; it is then poured into a large stone pan, and a slight excess of hydrochloric acid is added. After twenty-four hours' repose, the santonine is found more or less pure. By means of weak alcohol it is washed to remove the greater part of the resinoïd fatty matter, the deposit is pressed, treated by boiling alcohol and charcoal, and crystallized.

The acid hydrochlorate of lime, after twenty-four hours' repose, still retains in suspension a certain quantity of santonine ; it must be left to deposit for a longer time, and if the concentration has not been prolonged, the excess of acid must be saturated by a little milk of lime.

ON A NEW METHOD OF TESTING ARSENIC, WITH REMARKS ON THE METHOD OF REINSCH.*

BY ROBERT ELLIS.

It struck me, almost immediately after the publication of Reinsch's method, that if copper chips and wire possessed the remarkable property, as they do, of separating metallic arsenic from a solution of an oxide of the poison, it might so happen that arseniuretted hydrogen gas would also deposit *its* arsenic upon copper, if allowed to pass over it ; and to my equal surprise and pleasure I found, that, by the application of a very gentle heat, such proved to be actually the fact. I had previously altered and modified Marsh's instrument, in such a manner as to cause it to give me a constant and uniform stream of gas ; removing the brass stop-cock, which is objectionable on account of its being readily contaminated, after one experiment with gas, and its being also very difficult, if not impossible, ever to clean it thoroughly ; and substituting a glass one in its stead, ground into a tube bent like a syphon, and having three hollow globes on its long leg, and three of equal size on the shorter. All this seems complicated in description, but it is simple enough in reality, and the additional balls have the effect of enlarging the gas-room of the apparatus without materially increasing its bulk, and consequently the supply of gas is continuous and not intermittent, as in the original apparatus ; and, indeed, in the little instrument I use it often continues for hours, so as thoroughly to exhaust all the arsenic in the liquid under observation. I thought I had now a good opportunity of combining two or three different modes of testing in one apparatus ; these are the arsenical stain, the reduction test, and the new mode which I will now very briefly describe.

Several pieces of clean, brightly polished copper wire of about an eighth of an inch in diameter, or some slips of thin copper ribbon (the latter are most convenient) are to be introduced into a tube of either German or English glass—it does not matter which, as no great heat is used in the process—which may be bent into an elbow at one end, and fitted with a perforated cork, if no better instrument be at hand, to a Florence flask at that end, the other being drawn out after the introduction of the copper into the tube to a capillary size. Some of the suspected matter, fluid or solid, with some pure zinc, pure sulphuric acid, and a little water (these latter must all be tested as to their freedom from arsenic previously) is then put into the flask so as to generate the arseniuretted hydrogen ; this gas then passes over the surface of the copper wire, and may be burnt and tested in *that* way by the arsenical stain at the capillary extremity : a small spirit-lamp must, while the gas comes pouring over the copper, be held underneath it, so as to warm it for a few seconds, and almost instantly, if the arsenic be pretty abundant in the gas, the copper is seen to be frosted

* *The Lancet*, Nov. 11, 1843.

over with a coating of metallic arsenic, this deposit beginning at the end next the flask, and gradually extending until the whole surface is covered; the heat may be continued for a few minutes longer, and then withdrawn. If, however, the arsenic in the fluid being tested be small in quantity, then a minute or so may elapse before any indication of its presence is decisively given by the copper, but rarely longer. If it be requisite, and it is always expedient, to get as thick a crust as possible upon the copper, the heat must he continued for four or five minutes more; but if kept up after this, as no more copper surface remains exposed to the gas, and as probably the tube has become nearly red hot, then the arsenic begins to be deposited on the sides of the glass tube. It is rather singular that so long as any portion of the copper remains uncovered by this deposit, the sides of the tube will be perfectly clean and unstained. The copper may be then withdrawn, and it will be found to be coated with a beautiful silvery crust of arsenic; this soon loses its lustre, and the wire appears as if it had been transformed into zinc or lead. It is to be noticed that every portion of the surface is covered with this crust, both that more directly exposed to the gas, and also that next the tubing. If antimony have been present instead of arsenic, the wire is blue, often iridescent, and is only coated on the parts directly exposed to the contact of the gas; a much more intense heat is requisite to get a deposit at all, and the sides of the tube are invariably stained owing to this increase in the temperature. In two words, antimony requires more heat to decompose it than arsenic, when in combination with hydrogen gas, and this explains most of these phenomena, and, indeed, is of itself by no means an unimportant feature in the means of distinguishing the one from the other. The copper wire or ribbon is now to be cut into small pieces a sixth or a fourth of an inch in length, put into a tube drawn out at one end fine so as to prevent their slipping through, and heated gently over a small flame until the chips are nearly of a cherry-red heat.

I. If the deposit be arsenic, long before the crust is oxidized off, evidence, beautifully decisive and clear, is obtained of its presence in the deposition of the brilliant, glistening, transparent little crystals of arsenious acid, in a ring, presenting a sharply defined margin towards the copper chips, and shading gradually off towards the open larger end of the tube. A Stanhope lens is sufficient to complete the proof; the ring, which is distinctly—if I may use the word, unmistakeably—crystalline to the unassisted eye, is found on examination to consist of octahedral crystals, the triangular facets being presented to the eye; sometimes they appear tetrahedral, probably from the octahedron lying on its edge, and presenting the faces of the two opposed triangles towards the observer. I feel quite certain that any one who had but once seen them, could never again either forget or mistake any thing else for them. After their shape has been clearly made out, the farther proofs of their nature may be obtained, as Dr. A. T. Thomson and Dr. Christison have shown, by dissolving out the arsenious acid with a little water, containing a few drops of nitric acid or ammonia, dividing the solution into three parts, sending a little stream of sulphuretted hydrogen gas through one, and adding the solution of the ammonio-nitrate of silver and of the ammonio-sulphate of copper to the two others; and now the orange, the lemon-yellow, and the grass-green precipitates, decide the matter.

II. Suppose, however, the deposit on the copper is antimony, it must be treated in just the same manner, and it will be noticed that the heat requisite for obtaining any oxide is much greater than that in the case of arsenic; that, instead of the crystalline ring, a film of a white, amorphous, uncrystallized powder is obtained, sometimes forming an indistinct ring, never having so sharp a margin as the arsenical, and sometimes left like a delicate white dust along the length of the tube: altogether, the result of the process is as remarkably indefinite and uncertain in this case, as in the former it is definite and decisive.

You will, of course, perceive, Sir, that this oxidation test is that which was proposed originally, I believe, by the late Dr. Turner, so that all which is mine in the process is the first part of it—the method of getting the deposit. The whole matter appears infinitely more complex and difficult on paper than it is in operation; and, indeed, the chief beauty of the whole consists in its simplicity, its certainty, and the facility with which the most inexpert toxicologist may obtain his evidence. I at once admit, and, indeed, those who have troubled themselves so far as to wade to this depth in this account will almost anticipate my avowal, that inasmuch as Reinsch's test has been fairly proved to be somewhat—although, I think, not as much as is generally stated—more delicate than Marsh's, so it of necessity follows that it must be more delicate than mine, as both my test and Marsh's depend for their essence upon the generation of arseniuretted hydrogen gas.

The reasons which, perhaps, I may urge

why this method may be adopted with as much confidence, if not more, than that of Reinsch, are the following:—The arsenical deposit is more decisive in its aspect, and more readily and at once distinguished from that of antimony by its silvery lustre, and by the blue, sometimes powdery aspect of the latter; and the very process of getting the deposit gives some help to the tester to diagnose his poison, from the slight heat requisite to obtain it from arsenic. and the greater from antimony, the tube being clean with arsenic, stained with antimony, and the deposit being most frequently, if not always, on every portion of the surface, with arsenic, and chiefly on the exposed surfaces only, with antimony. For all practical purposes it is as delicate, and, I believe, is not affected, at any rate to any confusing degree, by the other metals, tin, bismuth, &c., which affect M. Reinsch's: on this, however, I do not lay much stress, as it requires more investigation than I have as yet been able to give.

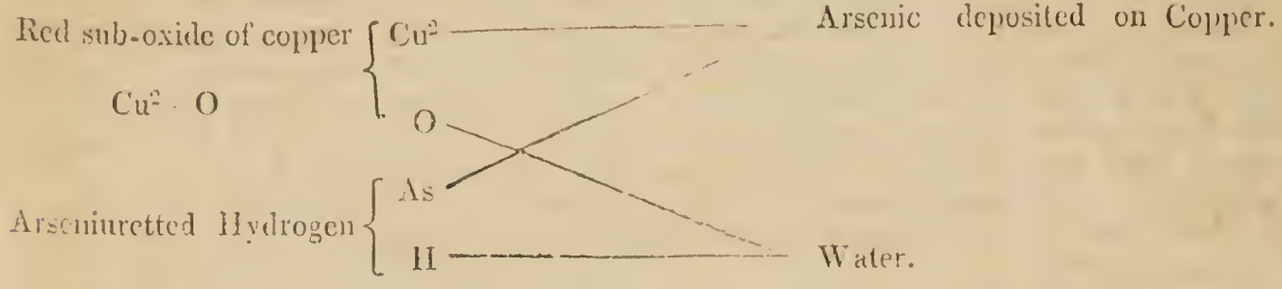
As to the question of its delicacy, I have little farther to state than this, that it seems to me that this point is overstrained. I have examined a great many reports of cases of poisoning by arsenic, and from all I can collect from them I cannot but infer that it seems improbable, at the least, that the poison should have been the cause of death, if it be not detectable from examination of either the vomited matters, the lining of the alimentary canal, the blood, and particularly the urine, if any can be obtained, by the generation of the arseniurretted hydrogen. So strong seems the affinity of arsenic to hydrogen to me, that the quantity must be almost infinitesimal if it will not show itself, and, if it *do*, then my test will find it out; so that, unless a man be poisioned by some homœopathic murderer, we shall have evidence enough to prove the existence of the arsenic by this method alone. I have particularized the urine, as I do not find, in the cases I have examined, any mention of *its* analysis; and Orfila has shown that the kidneys do their utmost when arsenic is in the system to get it out again, unless its narcotic effects shall have at all paralysed them: in some future case it might be worth while attending to this point.

I may mention, before proceeding further, that if the quantity of arsenic be very minute, it is advisable to keep up a constant gentle heat, confining portion after portion of the gas over the wire by closing the end of the tube, until all its arsenic has been deposited.

Thus, far, perhaps, it might have been foreseen, that arsenic *would* be deposited upon copper when heat was applied, as we find it deposited on the sides of the tube under apparently similar circumstances; but it is to be observed, first, that the heat requisite for the decomposition of the gas must in the latter case be carried to redness, while the copper requires much less intensity of degree; and, secondly, that the sides of the tube are left clean when copper is heated in the gas, facts which seem to prove that the arsenic has an affinity in the copper not depending on the chemical alteration produced in the gas by the heat alone. Even so far there is nothing either very unusual or very extraordinary; but I now come to a fact which does seem both new and singular. It is this: I have found that when copper wire or ribbon is exposed *per se* unheated, and unaided in any other way, to a stream of arseniuretted hydrogen it possesses the property of decomposing it, and causing the arsenic to be left as a metallic crust, just similar to that obtained in the former experiments upon its surface. This decomposition is rather slow; perhaps it may take twenty minutes or half an hour before all the surface is covered, but it is not the less certain. Let it now be tested by oxidation; cut the wire into small chips, and very carefully try them, so as to drive off some moisture on their surface, as this, if not driven away, rises with the crystals of arsenious acid, and is apt to dissolve off their angles, making them look like truncated cylinders. Heat them now as before; and as before will be seen that decisive and indubitable proof of the nature of the coating, the little crystals of arsenious acid, in a delicate zone on the tube.

This is not all, however. This deposit of arsenic will not take place (as far as I have been able to make out), unless the *surface* of the copper be in a particular condition; and when I first distinctly proved this, I was congratulating myself on my good fortune in being able to add another to the list of katalytic decompositions. However, my self-gratulation died away upon a little more reflection, and the apparently reasonable explanation of this singular circumstance will be given immediately. The particular condition of the surface to which I have alluded is rather remarkable. If the copper be perfectly bright and clean, I have never succeeded in getting any deposit on it when exposed without heat to the gas; but if, however, the copper be heated in a fire until it is dull red, and then suddenly plunged into cold water, although this last is not essential, but simply convenient for purity's sake, then it *will* decompose the gas. If this has been properly managed, and it requires very little attention to do so, the surface of the copper should be of a

maroon or reddish brown color; this seems to arise from superficial oxidation of the metal taking place while it is passed from the fire to the water. It must be observed, that if the copper be heated to bright redness, and then suddenly cooled, this oxide falls off, or the metal is technically said to "scale;" and *then* it again loses its decomposing power. All these circumstances go to prove that it is necessary to have a surface not of copper alone, but of its oxide; and I have found in a vast number of experiments that this is really the case; and I have by me now many specimens where the copper has partly scaled, and part not; and on the parts where the scale has not fallen off arsenic is deposited, while on the clean surface there is not a trace of it. This would seem at once to point to its own explanation, and that which seems most probable and rational to me is this:—We have an oxide of copper over which a gas containing arsenic and hydrogen is passed; the hydrogen I suppose to combine with the oxygen of the oxide, and to form water, while the arsenic is deposited on the copper in its metallic state. This may appear clearer by the following diagram:—



In support of this, I may add, that I have noticed the deposition of minute globules or points of water on the surface of the copper after it has been exposed to the gas, although I had taken means to dry the gas previously.

I have not heard of any explanation of the method in which arsenic is deposited in M. Reinsch's test: may I venture to offer the following rationale:—

We have hydrochloric acid and arsenious acid in solution in water, with slips of metallic copper; this solution, being heated to 212°, a chloride of copper is formed, and the hydrogen resulting from the decomposition may, I think, form arseniuretted hydrogen, from decomposition of the arsenious acid, the oxygen of which may unite with the proportion of hydrogen, and form water, while the arsenic is deposited as a metallic coating upon the chloride of copper, and the hydrogen again liberated to decompose a fresh portion of arsenious acid. If this explanation, complicated as it appears, be correct, then, after all, Reinsch's test is but a modification of Marsh's; but I fear some more learned chemist than myself will overthrow this theory of mine. I hope, however, some better one may be found in its stead. *Surface* appears to have no effect on arsenious acid in solution; that is to say, no arsenic is deposited on either a bright or an oxidated surface; and, indeed, if my explanation be correct, why should it, so long as we withhold the materials for the supply of the hydrogen, which appear the *sine quâ non* of the experiment.

I must, however, refrain from theorising further, as a young chemist in so doing always walks over hidden mines, and does not find out his error until he is blown up.

Do not, however, let me be misunderstood about this last process of mine. I do not urge *it* as a test for arsenic; it is too slow in operation, and is liable to be influenced by many trifling circumstances which might interfere with its indications. I have merely alluded to it in this paper, as I believe it to be a novelty in chemistry, and one that at first sight appears rather startling. I wish I could explain away all apparently katalytic actions, as readily as I hope this has been explained. It may be that some equally simple causes influence them, could they but be found out. I first found, that it required the surface to be modified, by accidentally putting into the gas a piece of wire which I had heated, and then cooled in water just to cleanse it from some impurity. I hope that there has not crept into this account any very serious mistake, as I have made some hundreds of experiments on the subject, fearing my own manipulation for some time, until at last I could not but be convinced that the facts are really those which I have occupied so much—too much, indeed—of your journal in detailing. I sincerely trust, however, some more expert and experienced toxicologist than myself will take up the matter, if it be worth the trouble, and then decide the accuracy or the falsehood of my experiments.

Before closing, I may add that I had the pleasure of showing the results of my first

process to that "Prince de l'Appareil du Marsh," as the French call him, Orfila, at Paris, who, while he smiled at the complicated aspect of my modification of Marsh's instrument, seemed pleased with the results of my test.

University College, Oct. 25, 1843.

POISONING OF A FATHER BY HIS SON.—ATTEMPT TO POISON A WHOLE FAMILY.*

During the present week a charge of murder and attempt to murder, under circumstances of almost unparalleled atrocity, has been under investigation before the magistrates at the Salford Town-hall. The accused is a young man named Joseph Taylor, twenty-three years of age, whose mother resides at Prestwich. He was first brought up on Tuesday, on a charge of having robbed his mother of 20*l*., but the theft could not be clearly brought home to him. The prosecutor, however, his eldest brother, stated, that he had a much more serious charge against him, namely, that of having poisoned his father, who was a farmer at Prestwich, in April, 1840; and with having, about six weeks after that time, attempted to poison the whole family. Under these circumstances the prisoner was remanded to Friday, when evidence to the following effect was adduced:—

The prisoner, it appeared, had a quarrel with his sister, Margaret Taylor, about a week before his father's death. In that quarrel, in consequence of the prisoner's violent conduct, his father interfered, and beat him, when the prisoner was heard to say, "He would do his job for him." About a week afterwards the father got up in his usual good health, and, after working in the garden for some time, took his breakfast alone at seven o'clock. The prisoner was up early that morning, but remained in the house whilst his father was at work and during the time he was at breakfast. In ten minutes after he had taken his breakfast the father was attacked with violent sickness, and complained of weakness in his back and legs, and one of the laborers on the farm was obliged to take him home. He continued to vomit violently during the whole of the day, and died in about forty-eight hours after the first attack. The prisoner, shortly before he died, had told one of his brothers that he would do something to his father; but no suspicion was entertained at the time that poison had been administered, and his death was attributed to English cholera. Some time afterwards, when suspicion was excited, Mr. Burrows, surgeon, of Prestwich, who had attended the deceased, was consulted, when he gave his opinion to the effect that if poison had been taken it would produce the same symptoms; but that, from the violent vomiting, there could be very little left in the system, so that there was scarcely a probability of its being detected by analysis. He also stated that he considered the immediate cause of death to be rupture of the vessels of the head, produced by violent vomiting. With respect to the subsequent charges against the prisoner, Mary Ann Taylor, his sister, proved, that about six weeks after her father's death, she got up early in the morning, and took from the oven some coffee which had been prepared by her and her sister the night before for witness's breakfast, as she was going a journey. The prisoner also got up very early that morning, and long before his usual time of rising. She observed that the coffee had a milky appearance, and that there was a sort of curd on the top. The taste was particularly unpleasant; and, in consequence, she threw it away.—Margaret Taylor, sister of the last witness, corroborated her testimony as to the taste of the coffee, and stated that about a week after this she had occasion to get up early, when she found upon a loaf which had been cut a quantity of white powder, the taste of which was precisely the same as that of the coffee. She cut off the part of the bread which contained the powder, and threw it on the fire. A few days afterwards, on taking some meal from a box in which it was kept, she put a small quantity of it in her mouth, when she was astonished to find that it had the same taste as the coffee and powder on the bread before-mentioned. She now became alarmed, and communicated the circumstance to her brother, William Taylor, who is a broker in Salford; they afterwards took some of the meal to be analyzed by a chemist (what chemist), who at once told them that there was acetate of lead mixed with it. Some of the meal they had preserved to the present time. On another occasion witness and her sister, Sarah Taylor, were sitting up after the rest of the family, and took milk for supper; they placed one of the basins they had used within the other, the uppermost having a teaspoon in it, and left them upon a table on going to bed. No one was up after them that night; but the prisoner rose first next morning. Witness rose soon afterwards; and, on going down stairs, found that the spoon had been removed, and was lying upon the table; and she observed that the bowl of the spoon was covered with powder similar to that which she had seen

* From the *Manchester Guardian*, Saturday, Dec. 9, 1843.

upon the bread, and the taste was similar. The spoon was shown to her brother, William Taylor, and he noticed that some one had attempted to wipe off the powder with a finger. Some time after this, the prisoner got up early one morning, and witness followed him down stairs almost immediately, for the purpose of watching him; whilst she made a fire, he went into an adjoining room where the coffeepot was. She had examined the coffeepot previous to his going into the room, and saw that the coffee was in its proper state. He had not been in the room long before she heard the lid of the coffeepot moved; and, on going to the door for the purpose of watching him, he came out of the room. She then examined the coffeepot, and found upon the lid, and also in the interior, a quantity of similar powder to that before described. She preserved the powder; and it was afterwards taken to Mr. Burrows, surgeon, who, upon examining it by several tests, pronounced it to be acetate of lead. During the whole of this period prisoner never took any meals at home, but boarded with his brother, for whom he worked, and who lived not far distant. The prisoner did not usually rise early in the morning; but, upon each occasion when the powder in question was found mixed with the articles of food, he rose much earlier than on other occasions. Eventually, it appeared, the different members of the family consulted together, and the prisoner was distinctly charged with having put poison into the food; they, however, could get no reply from him, and, being unwilling to prosecute, desired him to leave the place. He went away for six months, but then returned; when he was threatened with prosecution for attempting to poison the whole family, and also for having poisoned his father, unless he immediately ceased troubling them. After this, however, his mother received him at her house, since which, it appears, he has frequently robbed her.—On being asked if he wished to say anything in his defence, the prisoner on Tuesday said this charge was not brought against him until some months after his father's death, and that it had been brought against him through revenge, on account of the part he took as to his father's will. During the examination yesterday he said, in reference to the discovering of poison in the meal, "I believe it was never laid with the intention of doing any harm;" and, on being asked why he made that remark, he said, "Because it was malice against me, and was not brought against me till August." At the conclusion of the examination he was remanded to this day (Saturday), Mr. J. B. Smith, the presiding magistrate, wishing to have Mr. Maude's opinion on the evidence, and as to the propriety of the prisoner being committed to take his trial.

[We have, on former occasions, given expression to our opinion that medical men should not be called in as chemical witnesses in cases of this nature. Had the medical gentleman to whom the case of the poisoned man was communicated been sufficiently mindful of his duty, he would have caused an inquest to be held on the poor man's mortal remains. It was not for him to say that, as there had been violent vomiting, so little poison could remain in the system, that there was scarcely any probability of its being detected by analysis. Perhaps he does not know how minute a quantity of lead can be detected. It is well known that in cases in which large quantities of poison are taken, much is frequently got rid of by vomiting and by purgation; still, in these cases, absorption takes place.

If the case had been referred to a respectable chemist, sufficient evidence of the poisoning might have been adduced; if no poison had been detected, then the medical man might have set to work to trace the nature of the cause of death. In this case, there was very strong reason to presume that the deceased met his death by poison; but the fact was not *ascertained*, through the negligence of the practitioner.

NEW MODE OF PREPARING FLUID MAGNESIA.

To the Editors of The Chemist.

GENTLEMEN,—

A MONTH or two ago, being engaged in the manufacture of aërated waters, at Southampton, I discovered an improvement in the manufacture of magnesia water. The general mode hitherto, has been to mix the "magnes. carb." with the water, and after precipitation to use clean water for impregnation with carbonic acid gas: now, from the known solubility of magnesia in common water, it is obvious that a very inconsiderable quantity of the magnesia enters into the beverage by this mode of treatment, by far the greater quantity being thrown away as precipitate. It occurred to me to put a scruple of "magnes. carb." into each bottle, previous to their being filled, and bottling them in the

usual way, with water fully impregnated with carbonic acid gas; I was delighted to find that in from 20 minutes to half an hour the whole scruple was taken up, in other words, made soluble, and the beverage left as beautifully clear as soda water. How far this excels or falls short of Mr. Dinneford or Sir James Murray, I shall not stop to inquire. Doubtless it is a novel and most agreeable mode of exhibiting the "antacid magnesia," and you are at liberty to publish it.

I am,
Gentlemen,
Respectfully yours,
GEORGE RAISTRICK.

Battersea-bridge,
Oil of Vitriol Works,
11th December, 1843.

FORMULA FOR DYEING HAIR BLACK.*

BY DR. HANMANN, OF DRESDEN.

THE dangerous effects which may be occasioned by certain formulæ for dyeing hair black, and which are known under the names of Chinese powder, Italian powder, &c., are already known. To obviate the inconveniences which the use of these different products present, Dr. Hanmann, Professor at Dresden, proposes the following formula, which he has employed in many cases, and always with success. The only fault that can be found with it would be, favoring the formation of boils by the occlusion of the muciparous follicles of the skin:—

℞ Levigated litharge.... 275 grains.
Powdered quick-lime.. 1875 ,,
Hair powder ..... 930 ,,

Mix and F.S.A. a perfectly homogeneous powder.

In using this mixture, care must be taken to prevent any part of the powder from penetrating into the eyes, because ophthalmia would readily result from it.

To employ it, a sufficient quantity is put into a saucer, and converted into a thick paste by the addition of a sufficient quantity of warm water.

The paste obtained is applied to the hair, by means of the fingers, and taking care to bury the hair to the root. The whole is afterwards covered with a leaf of cotton wadding, slightly moistened with water, and which is kept in its place by means of a cloth, several times doubled.

This paste ought to be kept in its place for at least three hours, or, better still, during the night; for, indeed, the heat of the bed favors its action.

When it is necessary to remove this paste, which will have become dry and hard, it is easily effected, either by slightly rubbing the hair between the fingers, or by washing with soap and water.

Finally, if the hair be very rough, in consequence of the action of this compound, the desired suppleness may be restored to it, by greasing it with pomatum, and combing it.

The application is renewed, as the hair grows, and shows a white surface underneath.

* *Allgem. Med. Central Zeitung.*

MUSHROOMS IN BREAD.*

AN extraordinary alteration in the appearance of the bread furnished to the troops in Paris, and throughout France, during the heat of last summer, arrested the attention of the medical and military authorities, and the Duke of Dalmatia, Minister of War, directed that a commission should be appointed to inquire into its causes. M. de Joinville was president. Moien, member of the Board of Health; Brault, also a member of the board; Benier, principal officer superintending the provision of Paris; Chartier, the municipal syadic of the bakers; and Dumas, Pelouze, and Payen, members of the Institute, formed the commission. Marchand, the naturalist, Duvivier, the chief surgeon, and many of the best veterinary surgeons, pointed out the pernicious effects that had been observed in horses and animals fed upon the bread; but no bad influences had been observed in man; this, however, was rather to be attributed to the fœtid emanation, and the formation of a red powder, which was so disgusting, that no one would partake of it. MM. Leville, Montaigne, and Decaisne, together with M. de Mirbel, ascertained, by microscopic as well as by chemical inquiry, that a species of crytogamic vegetation formed upon the bread. It appeared under the shape of an orange-red substance, marked by a peculiar odor, and quite new to those who have made cryptogamic botany the subject of their study. M. de Mirbel ranks it amongst the family *oidium*, and the name given to it has been *Oidium aurantiacum*. Another species of vegetation appears, simultaneously with it, and the *Penicilium glaucum* is visible. These mushrooms may be observed upon bread under certain circumstances of humidity, of temperature, and of light

* *The Illustrated Polytechnic Review.*

which last exercises a very peculiar effect upon them, its absence depriving them of color. The commission entered very minutely upon the phenomena which produced this vegetation, showing that the moistness of the season, the increase and the intensity of light, was the cause of the development. It then proceeded to examine the seat of the disease of the grain, and, having arrived at the conclusion that it was in the external covering of the grain, which is rich in nitrogenised matter, in glutinous substance, and mineral concretion, it, therefore, recommended that, previous to the laying up wheat in the grain, it should undergo decortication, and that this would arrest the fermentation, which was the cause of the mischief complained of.

ON THE LOCAL APPLICATION OF CALOMEL IN CASES OF THE OPHTHALMO-PLENORRHŒA OF INFANTS.*

BY DR. LANER, OF BERLIN.

Dr. Laner is able to verify, according to what has already been announced by some practitioners, especially by Dupuytren, Fricke, and M. Mayor (of Losanne), that this remedy produces excellent effects in the second stage of all the inflammations of the conjunctiva, by favoring resolution, but that it is especially productive of advantageous results, in cases of scrofulous inflammation, by hastening the progress of the resolution, and by removing, as by enchantment, the distressing symptom of photophobia.

He is also able to acknowledge the justice of the interesting observation made by Fricke, that calomel, applied to a healthy or diseased eye, determines only a disagreeable but transient sensation, whilst it irritates and inflames the conjunctiva to such an extent as to give rise to chemosis, and that in a very short space of time, when put in contact with the eye of a patient, who is using a preparation of iodine internally.

It appears, from an observation of Fricke, that an iodide of mercury is in this case formed.

Drs. Kluge and Knippa, have, for some time, commenced employing this remedy, and its success has been at once so rapid and so decided, that no other treatment is resorted to in the obstetrical establishment of charity, at Berlin. The author exclusively employs it in all cases of ophthalmo-pleirhorrhea, and Dr. Liebold has assured him that in his *clinique obstetricale*, at Göttingen, its success has been no less decided than at Berlin.

The following is the mode of applying this treatment:—

A small hair pencil is impregnated with the finest possible powder of calomel; and, while an assistant raises the superior eye-lid, and lowers the inferior, the pencil is gently struck, so that the powder which escapes from it may fall on the surface of the eye. This operation may be repeated a second time, if, in the first, a sufficient quantity of calomel have not arrived on the surface of the conjunctiva.

The contact of this powder causes an irritation so slight that, immediately after the application, the patient can open the eye.

In the ophthalmo-plennorrhœa of newborn children, it should be resorted to on the appearance of the first symptoms of disease. One application, *per diem*, is sufficient; but, if the symptoms acquire great intensity, and, if the disease appears to make rapid progress, two applications should be made in the twenty-four hours. In this case, it is indispensable to wash the eye frequently, in order to free it from the abundant secretion; at the same time, it is advisable to favor alvine evacuations, by the internal administration of calomel.

In general, by means of this treatment, cure is obtained in from four to ten days.

* *Giornale per Servie ai Progressiv, &c.*

REMARKS ON TROMMER'S TEST FOR THE DETECTION OF A DIABETIC STATE OF THE URINE.*

BY DR. GOLDING BIRD.

In this article, after observing that the presence of sugar may generally be detected in the urine of diabetic patients, before the other symptoms indicate with certainty the existence of the disease, Dr. Bird proceeds to remark upon the various tests which have been proposed for detecting the presence of sugar. Of all the tests which have been proposed, he gives a decided preference to that proposed by Trommer, sanctioned by Professor Mitscherlich, and first published in Dr. Simon's "Physiologische und Pathalogische Anthropochemie," Berlin, 1842. Dr. Bird gives the following account of Trommer's test:—

"Add to the suspected urine, contained in a large test tube, a few drops of a solution of sulphate of copper; a very inconsiderable troubling generally results, probably from the deposition of a little phosphate of

* *London Medical Gazette*, Nov. 24, 1843.

copper. Sufficient liquor potassæ should then be added to render the whole strongly alkaline; a greyish green precipitate of hydrated oxide of copper falls, which, if sugar be present, wholly or partly redissolves in an excess of the solution of potassa, forming a blue liquid, not very unlike the blue ammoniuret of copper. On gently heating the mixture, nearly to ebullition, the copper falls in the state of suboxide, forming a red and copious precipitate. If sugar is not present the copper is deposited in the form of black oxide.

"This test is founded on a fact long known, but not previously applied to the detection of sugar, of the power possessed by some organic matters of reducing oxide of copper, as well as some other oxides, to a lower state of oxidation. It certainly is the most delicate of all the chemical tests hitherto proposed for the detection of sugar in the urine, and will readily detect it in diabetic urine, even when very largely diluted.

"It is important in using this test that no more of the solution of sulphate of copper be used than is sufficient to produce a decided precipitate on the addition of the liquor potassæ. If this precaution be not attended to, a part only of the black oxide will be reduced to red suboxide, unless a very large quantity of sugar is present, and thus the indications afforded by this test be rendered indistinct."

After alluding to a refinement of this test proposed by Simon, which he thinks unnecessary, Dr. Bird concludes by remarking that "the profession must remain greatly indebted to Trommer for putting it in possession of a test for the presence of sugar in urine so easy in its application, and so distinct in its indications, with the additional value of requiring but a few minutes for its employment."

EMPLOYMENT OF VERATRIA IN RHEUMATISMAL PARALYSIS.*

BY DR. KNAPP.

A LITTLE girl aged 11 years, was attacked, after a cold, with a paralysis of the right arm. This disease had already existed 4 weeks, when she was admitted into the Hospital of Charity at Berlin, where she stated that two years before, she had suffered from this affection which yielded only at the end of two months.

This child, who was of a strong constitution, and who, besides, enjoyed perfect health in all other respects, had the right shoulder rather lower than the left, the motions of the right arm were performed slowly and without energy, so that the hand, on this side, could not even be used for conveying food to the mouth.

The use of warm-baths and the application of a blister to the diseased shoulder were prescribed.

After having sustained the suppuration of this exutory, during 8 days, without any advantageous change having taken place in the arm, the blister was allowed to heal, and the employment of veratria, according to the following formula, was resorted to:—

℞ Veratria..... 25 centigrammes.
Lard ..... 30 grammes.

Mix and F.S.A. a perfectly homogeneous ointment.

This ointment was applied, morning and evening, in frictions. These frictions lasted a quarter of an hour, and the dose of ointment for each of them was of the size of a bean.

These frictions caused, in the diseased arm, a sensation similar to that of the pricking of pins: the first acted even with such force that the little girl cried.

After three weeks of this treatment the paralysis yielded, and the arm had completely recovered its motive faculties. The patient left the hospital entirely cured.

* *Rust's Magazin.*

CURE OF SCHIRRUS OF THE BREAST BY THE EMPLOYMENT OF IODINE.*

BY DR. FRIEK, OF GOLDAPP.

DR. FRIEK, being consulted in a case of schirrus of the breast, successfully combated this disease by the employment of iodide of potassium externally in the form of ointment, and internally according to the following formula:—

℞	grammes.
Hydrolate of melissa.....	60
Iodide of potassium.....	4
Compound elixir of oranges...	15

Mix and dissolve.

For a mixture, of which a tea-spoonful is administered morning and evening, at the commencement, in a cup of gum and water, suitably sweetened.

The dose should be gradually increased, according to the effects.

The author affirms, that, under the influence of this treatment, maintained for 26 weeks, the schirrus was radically cured.

* *Schmidt's Jahrbücher.*

SPECIFIC AGAINST THE VOMITINGS OF PREGNANT WOMEN.*

BY DR. PITSCHAFT, OF BADEN.

Dr. Pitschaft has found by numerous applications, that the following pills constitute a truly specific remedy for the vomitings which so cruelly torment most women at a certain period of gestation.

℞	centigrammes.
Creosote	15
Powdered hyosciamus	Q.S.
Distilled water	Q.S.

Mix and F. S. A. a perfectly homogeneous mass, to be divided into nine pills (of about 10 centigrammes each) which should be covered with silver foil.

He prescribes three per diem (morning, noon, and evening).

SYRUP OF ORANGE-PEEL (ANTI-NERVOUS TONIC).†

BY M. LAROZE.

℞	grammes.
Hydro-alcholic extract of Dutch curaçoa	1300
Distilled water to dissolve the extract	2200
Syrup of honey of Provence, clarified and entirely deprived of odor	7200

The extract is dissolved in water mixed with the syrup and boiled.

The hydro-alcoholic extract, when dissolved in water, loses 27 per cent. of its weight, which remains under the form of an oleo-resinous matter insoluble in water.

The syrup of orange-peel prepared by aqueous infusion, left much to be desired both as regards the doses and therapeutics. The above formula enables us to obtain a medicine always identical, always uniform in its curative effects. Its tonic and stomachic action is acknowledged in affections attributed to atony of the stomach and alimentary canal.

FREIBERG'S ESCHAROTIC SOLUTION.‡

℞	Grains.
Camphor	30
Bichloride of Mercury	460
Highly rectified Alcohol	450

Mix and dissolve.

This solution is employed with great advantage in the Hospital of Charity at Berlin, in cases of syphilitic vegetations, and especially against condylomes; it effectually destroys the condylomes which affect a large surface, but it has less effect on those of a conical and acuminated form. Its mode of application consists in spreading it on the previously excised diseased surface, or, if the excrescence be pedienlated, after the application of a ligature.

THERAPEUTICAL EMPLOYMENT OF ICE AND SNOW.*

BY DR. PITSCHAFT, OF BADEN.

It is known that the swallowing of small pieces of ice is successfully prescribed in cases of ileus, gastritis, and enteritis.

Zacutus Lusitanus, resorted, against bilious cholic, to the administration of snow in the dose of a few spoonfuls several times a day.

Dr. Pitschaft has successfully treated hæmoptysis by means of pieces of ice, and also by the sugared ices prepared by the confectioners.

According to circumstances, it is proper to adjoin to this remedy, blood-letting; but the author takes care to observe that these vascular depletions are injurious, if the hæmophysis is slight and repeated frequently. On the contrary, in cases of this kind, good results are derived from the application of bladders filled with ice, or cold lotions on the thorax.

Internally, nitre, sulphate of soda, with small doses of opium, are given.

VERMIFUGE LINIMENT.†

Castor oil	32	grammes.
Oil of absinthium	15	"
Oil of tansy	15	"
Dr. Peschier's ethereal tincture of penny-royal buds		
M. S. A.	20	drops.

This liniment is employed in frictions on the surface of the abdomen, and in an urgent case it may be rendered still more active by macerating a little bruised garlic in the oil of *tansy*.

This medicine, possessed of real energy, may present a valuable resource to the practitioner when it is necessary to administer vermifuges to young and indocile children, who absolutely refuse the application of these remedies by any other way than this.

* *Hufeland's Journal.*

† *Gazette des Hôpitaux*, November 28, 1843.

‡ *Rust's Magazine.*

* *Hufeland's Journal.*

† *Journal de Médicine.*

TOBACCO SMOKE.*

The experiments of Vauquelin, of Perfelt, Reimann, and of Underdorben, have satisfied us as to the general analysis of tobacco, and more particularly as to the presence of the powerful poisonous alkali, *nicotine*. It has been reserved for Teisc, Professor of Chemistry at Copenhagen, to analyse the smoke, which he has done very ingeniously, conducting the smoke through tubes of glass, surrounded by ice, into receivers, in which different reagents were placed. He principally employed the tobacco which comes from Porto Rico. The result of his examination is, that the smoke is composed of a peculiar empyreumatic oil, of carbonic acid, of muriate of ammonia, of parafine, and of a resinous compound. The absence of creosote is the most remarkable feature, and accounts for the irritating quality which is to be observed in the smoke of wood, and and almost all organic substances not being produced.

SOOTHING TOPIC IN HÆMOROÏDAL PAINS.*

BY DR. PITSCHAFT, OF BADEN.

Dr. Pitschaft affirms that there exists no better means to be employed for soothing, in cases of painful hæmoroïdal tumors, than the oil of the seeds of the *courge* (*oleum seminum cucurbitæ*).

A little pledget of lint, or, better still, *ouatte* cotton is imbibed by this oil, and applied to the orifice of the anus. It is needless to say that this application should be renewed several times until the cessation, or at least a considerable abatement of the pains.

IV. REVIEWS AND NOTICES OF BOOKS.

APPLIED CHEMISTRY, IN MANUFACTURES, ARTS AND DOMESTIC ECONOMY. Edited by E. A. Parnell. Part III. Taylor and Walton.

This part completes the subject of the preservation of wood, and commences dyeing and calico printing, and is well compiled. We must repeat our objection to this breaking off the subjects in the middle.

ANNOUNCED IMPROVEMENT IN "THE LANCET."

"The Lancet," we perceive, announces a considerable enlargement and improvement in its future numbers. For twenty years it has held the highest position in periodical medical literature, perhaps in the world; it has decidedly and unquestionably the largest and at the same time the most respectable circulation of any similar journal in this country. We are glad to perceive that the conductor has determined on adding to the size of the work, as the amount of matter interesting to the medical profession has long rendered this augmentation necessary, and we wish his enterprise all the success which we are confident it will be found to deserve. "The Lancet" has ever been the most powerful organ of the profession. However, with respect to many of the *details* of medical reform, we are at issue with our contemporary.

* *Illustrated Polytechnic Review.*

BOOKS RECEIVED.

"The American Journal of Science and Art," conducted by Professor Silliman and Benjamin Silliman, jun. Parts for July and October, 1843.

"The True Law of Population Shown to be Connected with the Food of the People." Second Edition, with a Postcript. By Thomas Doubleday, Esq. London: Effingham Wilson, Royal Exchange; G. Peirce, 310, Strand.

TO OUR CONTRIBUTORS.

We shall esteem it a favor if those gentlemen who intend to favor us with papers for our next Number will be kind enough to let us have those which belong to the department of Chemistry, by the 8th inst; those in Chemical Manufactures and Agricultural Chemistry, by the 12th; and those in Pharmacy, by the 15th.

We shall feel obliged if those who purpose to contribute in the course of the present year will favor us with their names as early as possible during the present month, at the time and which it is possible, to which department their articles are most likely to belong, as we intend to publish a list of contributors some time before the 1st of February.

* *Hufeland's Journal.*

TO CORRESPONDENTS.

A Reader, Edinburgh, is fortunate if he can obtain 16¾lbs. of extract from *one* cwt. of herb; Mr. Mowbray, using a very powerful hydraulic press, can average only 6lbs., and the cake left is as hard and dry as possible. The calculations of product are taken from Mr. Squire's results, in order that they may not be supposed to be partial. Will he read the paper attentively?

A Subscriber, Liverpool.—The questions you propose will be best answered by a sugar refiner or engineer, or by a visit to Mr. Mowbray's laboratory, to which we will furnish you with an introduction. If this answer do not sufficiently meet your questions, write again.

Explorator.—The balsam of copaiba must have been adulterated. Enable us to address you privately.

A Subscriber, Carmarthen.—We will write you, if furnished with address, &c.

Mr. Joseph White will find his request complied with in the articles we are about to publish on the subject of his communication.

A Lover of Chemistry, Oswestry, has been forgotten; he shall hear in a day or two.

Virtutas.—We must plead extreme pressure of business as our excuse.

P. M. and J. D. E. shall hear.

An Amateur.—Be good enough to transmit to us your name and address; you shall then have an answer to your letter.

J. F.—No; not on any account.

F.—We should be inclined to think otherwise.

Dr. S. will receive a note privately.

An Amateur (Devonshire).—Our correspondent may depend on our assistance; we admire his enthusiasm.

A Subscriber will find an answer on perusing the present number.

A Physician.—Will our worthy correspondent write and make an appointment, stating what time we shall have the pleasure of meeting him at our office as he proposes? We think, from the hurried style of his note, that he, unconsciously, forgot to name the time.

ERRATA IN NO. XLVII.

Page 494, col. 1, line 4, *omit* "I."

Page 494, col. 2, line 8, for 14 + 2 *read* 14×2.

Page 530, col. 1, line 3, for "nitrates" *read* "nitrate."

SUMMARY OF METEOROLOGICAL OBSERVATIONS MADE AT OTLEY, YORKSHIRE, IN NOVEMBER, 1843.

BY E. THOMPSON.

BAROMETER.

Monthly mean	29·58
Mean at 9 a.m.....	29·57
,, 3 p.m.....	29·58
,, 9 p.m.....	29.59
Maximum on 29th ..	30·21
Minimum on 21st ..	28·98
Range	1.23

THERMOMETER.

Monthly mean	38°
Mean of maxima	41
,, minima.....	35
Maximum on 4th	50
Minimum on 9th.....	28
Range.....	22

WIND.

Days.		Days
N. 0		S. 1
N. E. 3		S. W. 8
E. 0		W. 10
S. E. 0		N. W. 3

RAIN.

2·86 inches.

WEATHER.

	Days.		Days.
Clear.....	1	Frost.....	7
Cloudy	5	Hoar frost....	1
Overcast	4	Misty.....	4
Showers	16	Stormy	2
Continued rain	1		
Snow	1		

GENERAL REMARKS.

Pure November weather has prevailed during the month. The meteors which have for some years been observed about this time of the year, were not noticed here.

A malignant form of typhus has been very rife in the neighbourhood.

Nota Bene.—*All Communications, Books for Review, and Substances to be Analysed, must be addressed "To the Editors of the Chemist, 310, Strand, London." Communications must be prepaid, and sent before the 15th of each month; Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

ON ELECTRIC REPULSION.

BY REUBEN PHILLIPS.

The phenomenon of the mutual apparent repulsion of two bodies positively electrified, admits of an easy explanation on the theory of Franklin; but this theory fails to explain similar repulsions when effected by the negative electricity. The following, which attempts equally to explain both repulsions, may, perhaps, interest electricians.

Now, electric attractions and repulsions are found to vary as the square of the distance. The surfaces of spheres also vary as the squares of their radii. Assume, now, that electric induction may take place between any two bodies through the air, and separated by any distance, which is an assumption which may be ascertained by experiment within certain limits. Therefore, if a body lying in the centre of a sphere be electrified, the attraction between it and the spherical surface will be the same, whatever be the diameter of the sphere. If, now, any part of a smaller sphere be placed concentric with the larger, it will intercept a like part of the influence of the larger sphere, admitting the influence of the larger sphere as incapable of transmission through the segment of the smaller; therefore, the mutual influence of the central matter, and the parts of the spherical surfaces, will be the same as was the influence before the interposition of the segment of the smaller sphere. Now, as much may be said of any number of segments, of any size, of this sphere, or of any sphere smaller than the larger of the two we have been considering.

Hence we arrive at the following: that if any quantity of surface be disposed in any figure surrounding any electrified body, at any distance, the influence between it and the surface will be the same for all distances and figures; inasmuch as any particle of of that surface forms part of a sphere, of which the electrified body may be considered as the centre. Let there now be two parallel plans, A B, of infinite extent in all directions, and separated by a finite interval; then any electrified body, D, placed at any point between both planes, is subject to an influence equal to what it would receive were D the centre of a sphere, minus an infinitely small quantity.

Substitute for D two planes, D E, of finite extent, whose boundaries are rectilineal, and, moreover, that D E lie parallel to, and midway between, the planes A B.

If D E become negatively electrified, A B are positive by induction, and therefore have a tendency to move from their original position, owing to the attraction which exists between oppositely electrified surfaces, suppose D towards A, and E to B.

Let the planes D E be separated by some small interval; then, considering any particle of the surface E which lies towards the plane A as a vertex, and considering the plane D as perspectively projected on A, there is obtained a rectilineal figure on the plane A, the perimeter of which varies in the same proportion as does the interval between D E (the same may of course be said of any particle on the surface D similarly situated to the above one on E). Now, the areas of these figures on A represent the differences of the attractive force which is exercised between the two infinite planes and the interposed atom; since it has been shown that were D removed, any particle on E would be indifferent to any position between the two planes A B.

The areas of rectilineal figures vary as the squares of any one of their sides; hence,

if y represent the areas in square units at the distance of 1, as that distance increases we shall obtain the following values of y :—

At 1	the area is	=	y
2	,,	=	$\frac{y}{4}$
3	,,	=	$\frac{y}{9}$
4	,,	=	$\frac{y}{16}$

Considering y and its fractions as representing the numerical value of the apparent repulsion, this is precisely the law which has been established by experiment.

The demonstration being made to depend on the fact, that the areas of rectilineal figures vary as the squares of their perimeters, renders the proof applicable to all finite plane surfaces. And since curved surfaces, and the surfaces of solids, may be considered as made up of the edge particles of a great number of planes, therefore, the above proof embraces all forms of matter.

If induced electricity in the solid bodies on the earth's surface be the cause of the seeming repulsion of similarly electrified bodies, then should there be considerable difference in its intensity, as observed when the electrified bodies are more or less exposed to space; but such has not yet been perceived, so far as I am aware. The amount of any variation could, I think, be ascertained with considerable exactness by the aid of a De Luc's column. But I see no reason why the air may not be substituted in the above theory for solid matter, which would, perhaps, afford an explanation of the fact, that when the body D is brought within a certain distance of either plane, A B, it is no longer indifferent as to its position.

NEW AND SIMPLE MODE OF ESTIMATING NITROGEN IN ORGANIC SUBSTANCES.

To the Editors of The Chemist.

Gentlemen,—

As some doubts have lately been entertained respecting the accuracy of Will's method of determining the amount of nitrogen contained in organic matter, allow me, through the medium of your valuable periodical, to offer the following simple plan to the notice of your readers. I have employed it in a great variety of cases, and have found it so easy in execution, and certain in effect, that a general description seems to be all that is necessary. Added to this, I may observe, that the process has been successfully tried by my friend Mr. James Marsh, of the Royal Arsenal, Woolwich.

Having weighed out a quantity (I prefer 100 grains) of the matter to be operated upon, place this in a small flask, and pour over it sufficient pure concentrated sulphuric acid to make the whole into the consistence of cream, then apply heat so as thoroughly to char and carbonize the mass, and allow a portion of the sulphuric acid to evaporate: having allowed the whole to cool, pour in a portion, say two or three ounces, of distilled water, and saturate the acid by means of carbonate of baryta; filter and wash in the usual way, and then add an excess of chloride of platinum to the filtered liquor, and carefully evaporate to dryness; digest the residue in a mixture of alcohol and ether, and from the weight of the dry ammoniaco-chloride of platinum deduce the amount of nitrogen, as recommended by Will.

It is unnecessary to observe that the sulphuric acid should be distilled and highly concentrated, without both of which the result would be vitiated, for common sulphuric acid almost always contains sulphate of potassa, and unless the acid be concentrated, the destruction of organic matter might be incomplete, the object of the process being to cause the carbon, oxygen, and hydrogen to form carbonic acid, carbonic oxide and water, whilst the affinity of the sulphuric acid for ammonia produces a combination between the nitrogen and a portion of the hydrogen, which remain fixed as sulphate of ammonia. The other steps of this operation do not essentially differ from Will's, and require no comment.

I am,

Gentleman,

Very truly yours,

Lewis Thompson.

[We need only to remark that this very beautiful mode of estimating the amount of nitrogen in organic matter appears to be free from objection: to this we can the more readily testify from having witnessed the performance of the process by our talented contributor, at the Polytechnic Institution. To us it seems to leave nothing to be desired as regards either simplicity or accuracy.]

SOME IMPROVEMENTS IN THE ELECTRICAL MACHINE.

by reuben phillips.

The machine on which the following has been tried, is of the cylindrical construction. The machine originally had a varnished or oiled flap, which was attached to the upper part of the rubber: for this was substituted a piece of soft leather (in this instance stout kid, but probably calf would be better), of such a size as to be capable of rather more

than covering the rubbing surface of the rubber; one edge of this was glued to the lower part of the rubber, and the other was sewed to a piece of woollen material, known by the name of "stuff;" on this piece of leather is spread the amalgam, in the usual manner. The advantages of this arrangement are, that there is less friction between the flap and glass, and also a more perfect contact between the two, and the flap is also more securely attached. In the above machine, which is nearly a twelve-inch cylinder, it is advantageous for the flap not to approach within three or four inches of the points of the conductor, the conductor remaining in its usual position.

The next improvement consists in laying between the piece of leather, before mentioned, and the rubber, the end of a piece of tin-foil, or amalgamated "stuff," which is of such a length as to go rather more than a quarter part round the cylinder outside the above flap, and of a width equal to the flap. The increase in the power of the machine by this addition is very considerable: my mode of measuring it, is to fix a ball within a certain distance of the prime conductor, to count the number of sparks which pass during every revolution with the tin-foil or amalgamated flap turned back, and then to count the number of sparks which pass when the conducting flap is replaced, taking care to keep the motion of the cylinder as uniform as possible. I generally so adjust the distance of the ball from the prime conductor as, when the conducting flap is turned back, to obtain one spark every revolution of the cylinder; with the flap turned in its place, there is usually obtained two sparks instead of one, or sometimes five in two revolutions.

I prefer the amalgamated stuff to the tin-foil; for since the amalgam does not become oxidated to a perceptible degree by the action of the machine, it lasts until it becomes rubbed off by accidental friction during the cleaning of the machine, &c.; whereas the tin-foil, by being unavoidably bent, soon becomes broken; and besides, I think there is greater power with the amalgamated flap. The possibility of substituting tin-foil for the amalgam, shows that the office of this flap is solely that of a conductor.

INVESTIGATIONS CONCERNING AQUA REGIA, AND A PECULIAR PRODUCT TO WHICH IT OWES ITS PRINCIPAL PROPERTIES.*

BY M. A. BAUDRIMONT.

Although aqua regia has been known for more than ten centuries, and although it is frequently used, it has been the subject of but few investigations on the part of chemists. It is generally considered that it owes its property of dissolving gold to the presence of free chlorine: however, in 1831, Mr. Edmund Davy published a memoir, in which he endeavored to show that the active product of aqua regia is a peculiar gas, formed of equal volumes of chlorine and binoxide of nitrogen, uncondensed. He says that this gas has a specific gravity of 1·759, and he gave it the name of *chloro-nitrous gas*. The process followed by Mr. E. Davy, for obtaining this gas, consists in adding together fused chloride of sodium or potassium, and concentrated nitric acid. The nature of the reacting matters, and the composition assigned to chloro-nitrous gas, very clearly indicate that it is impossible to obtain this gas unmixed with chlorine, as the following equation shows:—

$$4\ NO^6\ H + 3\ Cl\ S^0 = 3\ NO^6\ So + NO^2\ Cl^2 + Cl.$$

The presence of chlorine in the pretended gas of aqua regia, having prevented its properties from being studied in a proper manner, I thought that new investigations might not be uninteresting.

When a mixture of two parts by weight of nitric acid and three parts of commercial hydrochloric acid are heated, a red gas begins to be disengaged towards the temperature of 187° F. If this gas be passed into a tube, around which ice is heaped up, it is deprived of the condensable portions. Experiment has shown that the first portions of the gas are mixed with hydrochloric acid gas, and that only the last portions are sufficiently pure.

This gas does not redden very dry litmus paper, but it decolors it in a few hours; it reddens it when it is wet. At 32° F., water dissolves 0·3928 of its weight, or 121 times its volume. This liquor is of a clear red; it has a specific gravity of 1·1611. When confined in a sealed tube, it is not decolored by a very prolonged action of the solar rays. It possesses, besides, all the known properties of aqua regia.

The gas of aqua regia attacks several metals, such as gold and platinum: powdered arsenic and antimony burn in this gas with light, when thrown into it; but it is a singular thing that it scarcely exerts a similar action on phosphorus, even when this body is in the state of fusion, and with the aid of heat. The active product of aqua regia does not unite directly with the metallic oxides: it gives a chloride and a nitrate, by an action which is easily explained. The quantity of chloride formed always exceeds that indicated by theory; that is to say, two equiva-

* *Comptes Rendus*, No. XXI., Nov. 1843.

lents to one of nitrate, doubtless because this product decomposes the nitrates, and converts them into chlorides.

When the gas of aqua regia is passed into tubes drawn out to a point, steeped in a frigorific mixture of common salt and ice piled up, it is liquified.

The liquid product is of a deep red, but much less deep than hypochlorous acid. It enters into ebullition at—7°·2 + C; its specific gravity at 45° F. = 1·3677. Its coefficient of dilatation, measured above its point of ebullition, in sealed tubes, increases very rapidly.

Between 32° and 42°·8 F., it is about 0·0020091.

Between 42°·9 and 61°·5, it is about 0·0035648.

Introduced into a tube of 12 millimetres internal diameter, containing another tube of 3 mm. 25 of external diameter, and 1 mm. 20 of internal diameter, the difference of the two levels of the liquid, at 42°·96F., = 5 millimetres.

Numerous attempts have been made to determine the index of refraction of this liquid, as well as its specific heat and the latent heat of its vapor; but the results which I have obtained are too imperfect to be published.

The specific gravity of the red gas of aqua regia, determined by two different processes, is about 2·49.

The liquid attacks all the metals put in contact with it. With pulverulent silver, arising from the reduction of the chloride of that metal, it makes an explosion, and immediately disappears. It is evaporated without attacking phosphorus.

Analysis has shown that the active product of aqua regia is formed of nitrogen in the following proportions:—

Nitrogen..	0·126	175	=	N
Oxygen ..	0·224	300	=	3O
Chlorine..	0·650	885	=	2 Cl
	1·000	1·360		NO^3Cl^2

The composition of this product indicates that it may be represented by a formula similar to that of anhydrous nitric acid, for $\overline{NO^3}\ O^2$ is similar to $\overline{NO^3}\ Cl^2$. This being the case, and taking as my guide the precedent acquired to science by the discovery of chlorosulphuric acid, I propose to call this body *chloronitric acid*, although in reality it is not an acid, since it does not saturate bases: 1 equivalent of chloronitric acid corresponds to six volumes of vapor.

The liquifaction of chloronitric gas, the boiling point of the liquified gas, its direct solubility in water, and its action on the metallic oxides, very evidently indicate that this body is of a peculiar nature, clearly defined, and that its composition corresponds to that of supposed anhydrous nitric acid.

INVESTIGATIONS CONCERNING THE EQUIVALENT OF ZINC.*

BY M. P. A. FAVRE.

Dr. Prout's hypothesis, resumed in an experimental point of view by M. Dumas, has become, in the hands of the latter chemist, a question of the highest importance. The experiments published by M. Jacquelain, for determining the equivalent of zinc, have determined me to undertake this work. The conviction expressed by M. Jacquelain, that the number, 414, given by him, is a minimum, would inevitably remove zinc from the series of the multiples of hydrogen. Certainly theories sanctioned by experiments must alone be accepted; but experiment having already pronounced in favor of the theory of multiple equivalents of hydrogen as regards a great number of bodies, I considered that new investigations concerning the equivalent of zinc were necessary.

The skill of M. Jacquelain left me no hope of arriving, by his method, which I discuss, at a better result: therefore, following another course, I have analysed various samples of oxalate of zinc prepared with the greatest care, and for whose purity I could answer. I endeavored to discover, also, the quantity of water decomposed for oxidizing a known weight of pure zinc.

FIRST METHOD.

The determination of the equivalent of zinc, by means of the oxalate of zinc, was executed by passing the gaseous products of the decomposition of this salt through a column of oxide of copper heated to redness, and by condensing the carbonic acid formed. Knowing the weight of this carbonic acid, and the corresponding weight of oxide of zinc obtained as a residue, we have all the data necessary for determining the equivalent of zinc, that of carbon being known.

The mode of experiment adopted has the advantage of furnishing all the elements of calculation in a single operation; besides, it allows of the abstraction of any water which the salt might accidently contain. The last experiments, executed with all the improvements suggested by the study of the

* *Comptes Rendus*, No. XXI., November, 1843.

process, furnished the following numbers for the equivalent of zinc* :—

1.	2.	3.	4.	Mean.
412·58	412·25	413·36	412·45	412·66

These numbers lead to the cipher 33·01 for the equivalent of zinc, that of hydrogen being taken as ninety.

SECOND METHOD.

The second series of experiments was executed by burning, by means of oxide of copper, the whole of the hydrogen furnished by the decomposition of water by means of sulphuric acid and zinc, this metal being employed in the state of purity and in known proportions. The water arising from the combustion of the hydrogen was collected and estimated by absorbing tubes. The apparatus employed is described in my memoir, as well as the precautions to be observed for drying the gases, and for forcing the whole of the hydrogen to pass over the incandescent oxide of copper. The zinc employed was purified by the process indicated by M. Jacquelain. To render this zinc attackable by sulphuric acid, care was taken to place it in a platinum capsule. The The quantity of zinc employed in these determinations was not less than 16 grammes, and in some experiments amounted to 68 grammes. The following are the numbers for arriving at the equivalent of zinc, taking 12·5 as the equivalent of hydrogen :—

1.	2.	3.	Mean.
412·27	411·77	412·42	412·16

These ciphers represent a multiple of the equivalent of hydrogen by the number 33. They agree very well with those obtained by the first method.

In concluslon, we have—

Equivalent of zinc by the first method	412·66
Equivalent of zinc by the second method.....	412·16
Mean	412·41

The equivalent of hydrogen being 1, that of zinc would, therefore, be represented by 32·991 (32·993 ?), a cipher very nearly approaching the entire number.

* The quantity of carbonic acid collected in the various experiments did not exceed eight grammes, and was not less than five grammes.

ON LEGUMIN.*

BY DR. ROCHLEDER.

The colytedons of leguminous plants contain a sulphuro-nitrogenous, substance, which its discoverer, Braconnot, designated by the name of *legumin*. The resemblance of the properties of legumen to those of the caseïn of the milk of animals, to which M. Braconnot calls attention in his work on this latter substance (*Annales de Chimie et de Physique*, *t.* XLIII., *p.* 347), induced Professor Liebig to give to legumin the name of vegetable caseïn. He has made analyses of this body, which gave in the following results :—

	1.	2.	3.
Carbon	54·138	55·05	51·41
Hydrogen ..	7·156	7·59	7·83
Nitrogen....	5·672	15·89	14·48
Oxygen } Sulphur } ..	23·034	21·47	26·28

According to these analyses, legumin contains carbon and nitrogen in the atomic ratio of 8 to 1 : they prove, therefore, the identity of legumin and caseïn.

MM. Dumas and Cahours have also, in their memoir, *On the Neutral Nitrogenous Matters of Organization* (for which see The Chemist, Vol. IV., 1843, pp. 10 and 49), published investigations concerning the properties and composition of legumin, which it is impossible to reconcile with the above-mentioned analysis, and with the properties of legumin indicated by Braconnot and Liebig.

The following are the numbers which, according to their analyses, should be regarded as the expression of the composition of legumin :—

Carbon	50·9
Hydrogen	6·5
Nitrogen	18·5
Oxygen.....	24·1†

These numbers show that legumin contains less carbon and more nitrogen than caseïn, and that these elements are not in the atomic relation of 8 to 1, as in caseïn. The difference between the properties possessed by legumin, according to the observations of Braconnot and Liebig, and those which MM. Dumas and Cahours assigned to the same body, very evidently arises from the following :—

Legumin is soluble in cold water ; the solution is not coagulated by heat (Liebig, *On the Nitrogenous Elements of the Animal*

* *Journal de Pharmacie*, Nov., 1843.

† According to these analyses, legumin would not contain sulphur ; which, however, is found in it, in considerable quantity.

Kingdom). By evaporation, by aid of heat, a pellicle is formed on the surface of the liquor, which is renewed as often as it is removed.

According to MM. Dumas and Cahours, cold water dissolves it in large quantities. If the liquor be evaporated at a temperature near boiling, it coagulates and precipitates coherent flocks, resembling coagulated albumen.

In the above-quoted memoir, Professor Liebig says:—"By the addition of acetic acid, it (the solution of legumin in cold water) immediately thickened into a mass of fine flocks, which do not dissolve in the excess of acetic acid."

MM. Dumas and Cahours say, in the before-mentioned memoir:—"If dilute acetic acid be added to a solution of legumin, it is immediately precipitated; an excess of acid dissolves the precipitate formed, and the liquor immediately becomes perfectly clear."

These contradictions would be difficult to explain, if MM. Dumas and Cahours had not themselves given the key to the explanation by the words which terminate the description of the properties of legumin: "*all the preceding experiments were executed with the legumin of bitter almonds.*"

The investigations which they quoted, incontestably prove that the body contained in almonds was not legumin. The resemblance in composition no more proves the identity of this body with legumin, than it authorizes us to declare its identity with albumen and fibrin. The above-mentioned work of MM. Dumas and Cahours has induced me to undertake these investigations, with which I have been intrusted by Professor Liebig. I at first extracted the legumin from beans, by pouring warm water on the seeds, freeing them from their envelopes, and washing them several times in water, until the warm water removed no more greenish-yellow color, and leaving them afterwards covered with warm water until they were softened and easy to crush. The mass obtained by pounding them was mixed with water, to which a few drops of ammonia had been added, in order to prevent the precipitation of the legumin by the lactic acid which is then formed. The mass mixed with water, was then thrown on a sieve; the liquor which ran out was left to settle in a close vessel, and, after all the starch was deposited, the supernatant solution was drawn out by means of a syphon. The addition of acetic acid precipitated from it a great quantity of legumin, in flocks of a pearly lustre. This precipitate was washed with cold water until it no longer removed from it any foreign substance.

For washing it, vessels with large openings, capable of being closed, were successfully used, which were entirely filled each time with fresh water, after having removed the washing water, in order to avoid the contact of the air and the alteration which it produces.

The substance, having been treated in this manner with water, was submitted to boiling, with alcohol, and then with ether, until they gave no more residue by evaporation.

The white legumin, thus purified, acquires by desiccation a dark grey color, which for the most part disappears by the pulverization of the substance. The powder of the legumin, dried at 206° F., is white, with a slight grey tint.

The legumin was extracted from two different kinds of beans, and purified in the manner indicated.

I. 0·3057 of legumin, extracted from a kind of small beans, left 0·0050 of ash = 1·634 per cent.

II. 0·6805 of the same substance gave, by combustion with chromate of lead, 1·2453 of carbonic acid, and 0·3915 of water.

III. 0·5237 of the same legumin gave, according to the method of MM. Varrentrapp and Will, 1·1327 of ammoniaco-hydrochlorate of platinum.

These numbers answer, in 100 parts, to the following composition:—

Carbon	51·15
Hydrogen	6·49
Nitrogen	14·01
Oxygen, Sulphur	28·35

The analysis of the legumin arising from the second kind of beans, gave the following results:—

I. 0·2907 of legumin gave 0·0064 of ash, or 2·20 per cent.

II. 0·4521 of substance furnished 0·8522 of carbonic acid, and 0·2784 of water.

III. 0·4305 furnished 0·4344 of ammoniaco-hydrochlorate of platinum.

The composition, in 100 parts, calculated according to these numbers, gives:—

Carbon	52·99
Hydrogen	6·99
Nitrogen	14·81
Oxygen, Sulphur	25·21
	100·00

I made use of the chromate of lead for the determinations of the carbon, in order to guard myself against an incomplete combustion of that element. For the determination of nitrogen, I employed the process of MM.

Varrentrapp and Will, not only because it is the most simple in execution, and because it is quite as accurate as all the others, but especially because, according to the assertions of some French chemists, this method contains within itself a source of error which gives an excess in the proportion of nitrogen. Every error in my determinations of their elements must therefore be in favor of MM. Dumas and Cahours.

Although the atomic relation between carbon and nitrogen is the same in the different analyses, the absolute quantity of carbon, hydrogen and nitrogen differs, and the analyses which I have made show that the difference is neither determined nor compensated by the proportion of ashes.

These differences may, however, be explained by admitting that legumin is mixed with another body of a similar composition, whose quantity varies.

To demonstrate the existence of such a body in legumin, it was necessary to find a solvent capable of dissolving legumin and leaving this body, or of removing it from the legumin, without dissolving the latter.

I found in potassa and ammonia the means of operating this separation.

The legumin which served for the following experiments was extracted from peas, which furnish it in greater quantity than beans. I obtained it by the process above indicated.

When the legumin had been washed with water, there was poured on it, avoiding elevation of temperature, some concentrated solution of potassa, in which the legumin was with facility completely dissolved. The solution thus obtained is not, however, clear; but it is turbid and opaque, owing to the presence of a body which is held in suspension in it.

When left for a few minutes to settle, the liquor becomes clear; the above-mentioned body is deposited in bulky flocks.

The clear liquor is separated from the precipitate by means of a syphon, and it is filtered in order to obtain it perfectly pure.

It is as well to divide the liquid on several filters, because it filters very slowly, and be-it might easily undergo alteration in the air if it remained for a long time in the filter.

An excess of acetic acid is added to the filtered and clear liquor, and a floculent precipitate of legumin is then formed, which is washed with water until no more acetic acid or acetate of potassa is dissolved out.

In order to purify legumin still further, it is afterwards treated with liquid ammonia, with which it forms a turbid solution, which may be clarified by filtration.

The clear solution of legumin in ammonia is precipitated by acetic acid, and the acetate of ammonia is removed by washing.

The legumin, thus purified, is then treated by boiling alcohol and ether, until they dissolve no more.

It was not possible for me to effect by other solvents a fresh separation of legumin from other substances.

The legumin prepared in this manner was dried in an oil-bath, at 266° F., and employed in the following analyses:—

I. 0·2936 of substance left, by combustion, 0·0209 of ash, or 7·118 per cent.

II. 0·3231 of the same substance gave 0·5938 of carbonic acid, and 0·2030 of water.

III. 0·3175 of legumen gave 0·5870 of carbonic acid, and 0·1953 of water.

IV. 0·3296 gave 0·6050 of carbonic acid, and 0·2014 water.

V. 0·3175 gave, according to the method of Varreutrapp and Will, 0·6812 of ammoniaco-hydrochlorate of platinum.

VI. 0·4530 furnished, by the same method, 0·4277 of metallic platinum.

VII. 0·2729 of substance yielded, by this method, 0·2649 of metallic platinum.

These numbers answer in 100 parts to the following composition:—

	II.	III.	IV.	V.	VI.	VII.	Mean.
Carbon	54·41	54·73	54·33	,,	,,	,,	54·49
Hydrogen	7·54	7·35	7·31	,,	,,	,,	7·40
Nitrogen	,,	,,	,,	14·67	14·60	15·00	14·78
Oxygen, Sulphur	,,	,,	,,	,,	,,	,,	23·33
							100·00

The combustions were executed with chromate of lead.

These analyses give about 3 per cent. of carbon more than, and at least as much nitrogen as those of MM. Dumas and Cahours, and show a perfect accordance with the numbers obtained in the analysis of caseïn. The following is the mean of the analysis of the caseïn of milk, the proportion of ash, which is about 0·3258 per cent., being deducted:—

	Caseïn.	Legumin.
Carbon	54·31	54·49
Hydrogen	7·14	7·40

The carbon is to the nitrogen, in legumin, as 8 to 1. Caseïn and legumin are, there-

fore, identical in composition, and their difference consists only in their different mode of acting with acetic acid, as Professor Liebig has long since indicated.

Legumin purified in the manner above pointed out, and which was used in the foregoing analyses, differs in some properties from the same substance impure. Pure legumin does not acquire a grey color, but a yellow color, and is easily reduced to a white powder, slightly yellowish after desiccation; does not swell up by heat; like impure legumin, it is very soluble in potassa, soda and ammonia, but without residue. In these solutions it resembles caseïn, from which it is distinguished by its insolubility in an excess of acetic acid.

The solution of pure legumin in potassa is altered by long exposure to the air, from eight to ten days, for example. White flocks are separated from the solution, and ammonia is disengaged at the same time. If legumin be boiled with a solution of potassa, ammonia begins to be disengaged only when the liquor is sufficiently concentrated to solidify by cooling. The ammonia which is disengaged has an odor similar to that which is developed by the boiling of bile with potassa.

If the ebullition with the solution of potassa of moderate concentration be continued for a long time, the evaporated water being replaced from time to time, blackish flocks are separated, and a brownish solution is produced, which precipitates, by the addition of acetic acid, grey flocks of a body soluble in an excess of that acid; properties which indicate the presence of protein.

Submitted to ebullition with nitric acid, legumin forms, with the disengagement of vapors of nitrous acid, a yellow solution, which becomes red by the addition of ammonia or potassa. It appears, therefore, to be formed of *xantho-proteïc acid*.

Professor Liebig has said, in his *Memoir on the Nitrogenous Elements of the Vegetable Aliments*, that the legumin precipitated by the acids always has an acid reaction. It has been thought that this reaction belongs not to the legumin, but to its combination with the acid employed in its preparation. Mr. Jones has shown that legumin precipitated by sulphuric acid does not contain sulphuric acid. This observation, as well as the acid reaction of caseïn, which reddens moist litmus paper, even when it is precipitated from the solution in water acidulated by sulphuric acid, by means of an alkaline carbonate, and when a sufficient quantity of the latter is employed to neutralize the liquor, tend to prove that the acid reaction belongs to the legumin itself.

Another proof in favor of this opinion is, the constant relation between the carbon and the nitrogen in the analyses of legumin precipitated by sulphuric acid and by acetic acid.

The impure legumin of beans, which I had precipitated by acetic acid, contained 52·99 of carbon, and 14·98 of nitrogen; the legumen precipitated by sulphuric acid gave, by Varrentrapp and Will's mode of analysis 15·41 of carbon, to 14·48 of nitrogen.

Legumin, insoluble by itself in the pure state, therefore owes its solubility, in the seeds of leguminous plants, to the presence of inorganic principles, to which also is due the solubility of the caseïn in the milk of animals.

The body which remains in the treatment of pure legumin by the solution of potassa, is presented, after washing with water and boiling with alcohol and ether, under the form of a brown-grey powder, which gives out, by combination, an odor of horn and burnt bread, and leaves a considerable quantity of ash, without swelling up.

NOTE RELATIVE TO THE FOREGOING MEMOIR.*

BY MM. DUMAS AND CAHOURS.

The analyses of legumin, published by Dr. Rochleder, and the properties which belong to this product, do not satisfactorily establish its identity with the caseïn of milk.

According to this chemist, legumin, precipitated by means of weak acetic acid, from water in which peas and beans have been digested, reduced to a pulp, would be partially soluble in potassa, and might be divided by this reagent into two products, one of which, soluble in the alkali, would be identical with caseïn. However, the caseïn of milk has given, to all experimenters, 15·8 of nitrogen on the average, whilst the product obtained by Dr. Rochleder gives him an average of 14, $\frac{1}{13}$ less, which supposes so great an impurity in the product that no conclusion can be drawn from it. Dr. Rochleder, who puts in comparison the carbon and hydrogen in these matters, has wrongfully neglected to compare their nitrogen; moreover, a sample of the legumen of beans, containing only 53 per cent. of carbon, would give in legumin converted into caseïn, 54·5 of carbon, a fact difficult to explain.

Dr. Rochleder has not resolved the question relative to legumin; we have no doubt that the nitrogenous matter of the leguminous plants contains two distinct substances, of

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* *Journal de Pharmacie*, Nov., 1843.

different composition, which enter in variable proportions in the different leguminous plants, or even in the different samples of the same species.

We have extracted from hempseed, by the same means, a matter which sensibly contains the same carbon as the legumin of almonds, and which contains from 14·8 to 15 per cent. of nitrogen.

If there exist, indeed, two distinct matters containing the same proportions of carbon and hydrogen with different quantities of nitrogen, this latter element would alone be susceptible of variations in the different samples analysed.

Be it as it may, we have not hitherto thought it proper to confound with caseïn a product precipitable, cold, by very dilute acetic acid, nine-tenths of which are soluble in concentrated and cald acetic acid, and entirely coagulable by heat.

ON THE COLORATION OF SALTS.—NEW OXIDE OF IRON.*

BY M. BARRESWILL.

M. Barreswill has undertaken to examine, one by one, the *anomalies* of color which certain salts present. In a first memoir, read in his name, to the Academy of Seiences, by M. Pèlouze, he treats of the blue eoloration produeed by gallic aeid in the salts of peroxide of iron. We now give a succinet summary of the conelusions at which he has arrived on this important subjeet, which is connected with the history of onc of the most anciently-employed and least known ehemical compositions—writing ink.

It was already known that tannin and gallic acid do not precipitate the protosalts of iron, and produce a reduction in the persalts. The author has set out from this point, at which he had arrived, and has made, among others, the following experiments, with the view of ascertaining whether the oxygen necessary to the reaction combined with the acid or with the base. He has found: 1st, that the oxalic acid causes the blue to disappear, which reappears when an excess of acctatc of soda is added; 2nd, that the blue coloring principle, which is only in suspension in the liquor, contains at onee protoxide and peroxide of iron; 3rd, and finally, that with a protosalt of iron and gallic acid, oxidized to different degrees by the ordinary oxidizing agents, the blue was not obtained, any more than with gallic acid and a persalt of iron in great excess. He has concluded, from these faets, that the acid of the blue eombination is, indeed, gallic acid, and the base an intermediate oxide of iron.

To render this view more positive, M. Barreswill endeavored to prepare other salts of the same series: he was able to obtain the very stable blue phosphate of iron which is presented in nature, and in which Berzelius had found the two oxides (protoxide and peroxide), and a blue *sulphate*, whose production is most interesting. This salt is one of the most unstable.

It is not rare, in chemistry, for oxides, often the least stable, to give salts of great stability, for bases regarded as feeble, to combine with equally feeble acids, which are not displaced by energetic acids. Are these faets anomalies? or, rather, are not the eireumstances under which we are ordinarily plaeed peculiar cases? This, ulterior investigations will enable us to decide: we may state, however, that facts of this kind are becoming daily more numerous.

To prepare the blue sulphate of iron, we take saturated solution of sulphate of protoxide without heat, divided into seven equal parts, pour four parts into a capsule and convert them, by means of nitric and sulphuric aeids, into sulphate of peroxide, which is dissolved in the remaining three portions of protasalt; this solution is then introduced into a glass, and concentrated sulphuric aeid is slowly added; the water being removed by this reagent, the two sulphates cannot be separated, they combine and produce a mass of very pure blue, which resembles Prussian blue in intensity. This compound is very unstable; watcr decomposes it into salt of protoxide and salt of peroxide; like the gallate, it exists only in the *insoluble* state.

This mixture of the two sulphates of iron, triturated with phosphate of soda, reduced to powder, gives an abundant precipitate of blue phosphatc of iron. The water is solidified by the sulphate of soda formed in the double decomposition.

It is only by synthesis that the author has hitherto been able to determine the eompoSition of the blue salts of iron. It is a remarkable thing that the formula which he has given as probable, from numerous experiments, is precisely that of Prussian blue, oxygen replacing the cyanogen (if, however, Prussian blue is not an hydrocyanate of the blue oxide). This concordance of color is found in the other two corresponding combinations of iron with cyanogen and with oxygen. The protoxide and the protocyanide are white, the peroxide and the pereyanide are red; and if we compare, as the author

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* *Journal de Pharmacie*, Dec., 1843.

does, the green arseniate of iron, the formula of whose base is $FeOFe^2O^3$, with the green cyanide of M. Pèlouze, $FeCyFe^2Cy^3$ (which may also be considered as a hydrocyanate*), the analogy becomes still more complete. The arseniate is not the only intermediate salt of iron which is green; and ammonia produces in the protosalts of iron a white precipitate, which very soon becomes green, absorbing oxygen.

The foregoing observations on gallic acid apply to tannin, and to the red and yellow coloring principles which give, with the salt of iron, violet, brown, black, puce and olive dyes. They also confirm the remark of the authors who have treated on the printing of stuffs, that the iron mordaunts should be at a certain degree of oxidation, which is not precisely that of the peroxide; finally, they agree with the opinion formerly expressed, by M. Frény, sen., that, to have good ink, it is necessary to operate on a mixture of persalt and protosalt. It is a reaction of the same order which hyposulphite of soda, morphia and salliculous acid present, which transiently imparts a violet color to the salt of the peroxide of iron.

NOTE ON THE FOREGOING MEMOIR OF M. BARRESWILL.†

BY M. PERSOZ.

In a letter addressed to the Academy of Sciences, M. Persoz has made a reclamation concerning the memoir of M. Barreswill, raising a question of priority. M. Persoz expresses himself in the following manner:—

"When I made the remark, that the sulphate of peroxide of iron is very soluble in alcohol, contrary to the sulphate of protoxide, which, as is known, is completely insoluble in that vehicle, I had the idea of applying this fact to the verification of a proposition already made by M. Chevreul, to ascertain whether gallic acid, put in contact with sulphate of peroxide of iron, not only removes the peroxide of iron from the sulphuric acid, but whether an action takes place between the first of these acids and the peroxide of iron, the result of which is to oxidize the gallic acid at the expense of the oxygen of the peroxide of iron, which is thus found reduced. With this view, I dissolve separately in alcohol pure gallic acid and dried sulphate of peroxide of iron. These two solutions put in contact, and heated from 140° to 160° F., were colored of a fine blue, and a white crystallized deposit was formed at the same time, which, from all its characters, was easily recognised as sulphate of protoxide of iron. This deposit was accompanied by small resinoid drops, which congealed by cooling.

"We will not here enter into the detail of the applications which may flow from the very simple experiment which we have made; we well content ourselves with saying that, by it, two facts are acquired to science, the one that gallic acid, as M. Chevreul had announced, does not purely and simply combine with the peroxide of iron; the other, that the oxide of iron was reduced, and that a portion passes to the state of protoxide of iron, which is separated from the alcoholic solution in combination with sulphuric acid.

* Prussian blue and the green cyanide of M. Pèlouze, differ from the other cyanides; they contain water of composition which cannot be driven off without decomposing them.

† *Journal de Pharmacie*, Dec., 1843.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE VARIOUS METHODS OF ALKALIMETRY.

BY CHARLES WATT, JUN.

The first method employed for ascertaining the quantity of real alkali contained in the soda-ash and pearl-ash of commerce, to which any importance attaches, consisted in the use of an instrument termed an *alkalimeter;* and numerous and skilful have been the contrivances invented by chemists to render this instrument trustworthy; but it has been found by all who have had any experience in this class of analyses to be encumbered with defects. The results which it furnishes are mere approxima-

tions, which answered every purpose at the time when it was first introduced; but it is quite incapable of satisfying the present demands of buyer and seller. It has now become necessary to assay to the *tenth part* of a per cent.; but at that period the difference of even one per cent. was little heeded.

The following are some of the most important objections to the use of this method:—

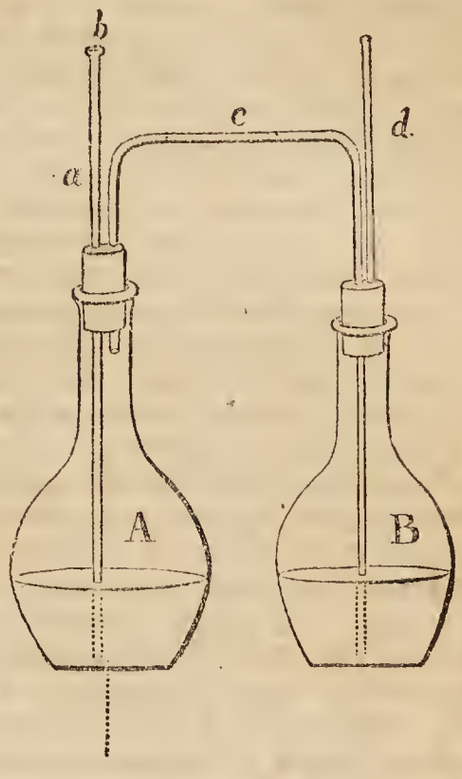
I. That the test acid, being prepared by its specific gravity, is affected by variations of temperature, expanding by increase, and contracting by diminution of heat; and, as the quantity of acid required to neutralize the sample of alkali under examination is determined by *measure*, the acid which at 60° F.,—that, probably, at which it was prepared,—would furnish a *nearly* correct result, at 50 or 70° F.,—temperatures very common in this country,—would give an inaccurate result. Even holding the instrument in the warm hand whilst performing the operation, and marking the quantity of test acid used before it has become cool, will render the analysis incorrect. I would wish it to be borne in mind by the reader that, although the tenths over the round numbers are never paid for by the purchaser, yet it sometimes occurs that one or two tenths will turn the per cent. one way or the other, and, consequently, it is *absolutely necessary to perform the analysis accurately to one-tenth of a per cent.*—100 grains of alkali being operated on.

II. *The utter impossibility of measuring with absolute accuracy.* Should any one be desirous of ascertaining the truth of this proposition, let him take a graduated tube, similar to an alkalimeter, fill it, to a given mark, with any liquid, carefully weigh it, empty it, refill to the same mark as precisely as he can, and place it in the balance with the same weights he used before, and he will then learn how *accurately* he can *measure*, and will, I think, be convinced that, in the performance of an analysis where correctness to the tenth of a grain is indispensable, *no measuring plan is admissable.*

I may also mention, as objections to the use of the alkalimeter, the difficulty of obtaining a correct instrument, and also the fact of the acid, at the strength ordinarily used in it, rapidly attracting moisture from the atmosphere, should the stopper be accidentally left out of the bottle, thus becoming weaker, or, in other words, incorrect.

The next method of testing the per centage amount of alkali in the soda-ash and pearl-ash of commerce which I shall notice, is that lately proposed by Drs. Will and Fresenius, a description of which I extract from their own work, translated from the German by Mr. J. Lloyd Bullock, p. 16*:—

"A and B are two flasks (wide-mouthed bottles even may be employed); A must



have a capacity from 2 ounces to 2½ ounces of water; it is advisable that B should be somewhat smaller, say of a capacity of about 1½ to 2 ounces. Both flasks are closed by means of doubly-perforated corks. These perforations serve for the reception of the tubes *a*, *c*, and *d*. All these tubes are open at both ends when operating; the end *b* of the tube *a* is closed by means of a small piece of wax. The substance to be examined is weighed and projected into the flask A, into which water is then poured to the extent of one-third of its capacity; B is filled with common English sulphuric acid to about half its capacity. Both flasks are then corked and the apparatus is weighed.

"The air in the whole apparatus is then rarefied by applying suction to the tube *d*; the consequence is, that the sulphuric acid contained in B ascends into the tube *c*, and thus a portion of it flows over into A. Immediately upon its coming into contact with the carbonate contained in this flask, the evolution of carbonic acid begins briskly. The peculiar construction of the apparatus compels the carbonic acid evolved to pass through the sulphuric acid contained in B, before it is permitted to escape through the tube *d*, this being the only aperture of the apparatus. It is obvious that

* Published by Taylor and Walton, Upper Gower-street.

this transmission through sulphuric acid will retain all the moisture with which the carbonic acid may be charged more completely than could be done in any other manner. Upon the influx of the sulphuric acid, the fluid in A becomes heated, and expands, together with the air contained in the flask; upon cooling, both acquire their original volume again, owing to which a new portion of the sulphuric acid flows over into A, as soon as the evolution of the gas has ceased. In the early part of the operation, moreover, the carbonic acid evolved in A is absorbed by that portion of the alkaline carbonate which has not yet undergone decomposition (giving rise to the formation of sesquicarbonated or bicarbonated alkali), and this assists the passage of the sulphuric acid from one flask into the other; the operation would, however, require a considerable time for its completion were we to leave the passing over of the sulphuric acid from B into A without aid; we, therefore, rarefy the air in the apparatus by sucking the tube *d* every time the evolution of gas stops; the operation may in this manner be accomplished in a few minutes. When the carbonate is completely decomposed (which is immediately ascertained by no further evolution of gas taking place upon the influx of fresh portions of sulphuric acid into A), a somewhat larger quantity of the sulphuric acid contained in B is, by means of renewed suction, made to pass over into A; the fluid in A hereupon becomes heated to such an extent as to expel all carbonic acid which it had absorbed in the course of the operation. As soon as the evolution of gas has completely ceased, the aperture *b* of the tube *a* is opened by taking off the piece of wax, and suction applied to the tube *d*, until all the carbonic acid still contained within the apparatus is replaced by air, and thus until, upon further suction, nothing but air is obtained. The apparatus is then allowed to cool, wiped dry, and weighed. The loss of weight indicates with the greatest possible exactness the amount of carbonic acid which was contained in the test specimen."

All the soda-ash and some of the pearl-ash of commerce contains a portion of caustic alkali: this they convert into carbonate by means of carbonate of ammonia, as follows, previous to performing the testing operation:—

"Should caustic potash be present, the 6·29 grammes of anhydrous potash are triturated in a mortar, together with three or four parts of pure quartz sand,* and carbonate of ammonia added, to the extent of about one-fourth or one-third of the quantity of potash. The mixed powder is then carefully projected into a little basin, and as much water added as the mass can imbibe; the mass is allowed to stand for some time, and a gentle heat is then applied, till all the water is expelled. After this, the residue contains no longer any trace of carbonate of ammonia. Should the potash under examination contain sulphuret of potassium, besides caustic potash, solution of ammonia is substituted for the water in moistening the mass; this is done in order to reduce the sesquicarbonate of ammonia to a neutral carbonate; or else hydrosulphuret of ammonia would be evolved, and one portion of the sulphuret of potassium be converted into carbonate of potash." Page 59.

And again, page 63.

"The various kinds of soda, however, containing sometimes caustic soda to a rather considerable amount, it is advisable to add the carbonate of ammonia to the extent of at least half the quantity of the test specimen (*i. e.* 2·42 grammes, the specimen weighing 4·84 grammes). The operation in every other respect is conducted exactly as Section 14 (3) directs; the same applies to the contamination with an alkaline sulphuret."

Now, the old method of preparing the bicarbonate of soda (which, I believe, is still practised at Apothecaries' Hall), consisted in the addition of carbonate of ammonia to carbonate of soda, pure ammonia being liberated; it must be evident, therefore, that, in this process, some sesquicarbonate or bicarbonate will be formed, and thus, unless in the hands of those who are skilled in such operations, incorrect results must be furnished. I do not mean to say that by subsequent heating, as directed by Drs. Will and Fresenius, *much* of the extra proportion of carbonic acid thus acquired is not driven off, or that if a red heat were employed, the *whole* might not be got rid of; but let chemists mark the expression used—"GENTLE heat." I contend that if this process be placed in the hands of the uninitiated, but little can be hoped for from its delicacy. But let us here stop to examine into its accuracy in the hands of the skilful chemists whose invention it is. I quote some analyses made by them of chemically pure carbonate of soda:—

"The substances yielded:	They ought to have yielded, according to theory:
1. 41·61	41·30
2. 41·30	41·30
3. 41·82	41·30
4. 41·45	41·30
5. 15·39	15·35
6. 15·55	15·35

* The employment of sand is necessary, to prevent the mass becoming too compact, projecting off parts when drying, &c.

It will be perceived that, in one of these experiments, the incorrectness amounts to half a per cent. in an analysis (3) published by themselves as a proof of the *accuracy* of their system; and I can assure these gentlemen that such results would not do in the London market. What, may I ask, can be expected from a process capable of giving only the results here quoted when placed in the hands of parties I could name? I have no hesitation in pronouncing it utterly unworthy of confidence, and in asserting that at present we have nothing to learn on this subject from our German brethren, although they seem to think it in their power to teach us much. It should be borne in mind that disputes generally arise, not as to the round numbers, but as to the last few tenths. In the work from which I have quoted, a comparison is made between the method of Drs. Will and Fresenius, and the test acid prepared by Gay-Lussac's method, to the disparagement of the latter; but the results they give only tend to prove that these gentlemen have not performed the analysis correctly, or that the acid which they used was not pure, and, consequently, it was useless to test it by salts of baryta. Did they determine this?

A great objection to the employment of any method of assaying alkalis by which the quantity of alkali is calculated from the amount of carbonic acid which can be evolved from it is, that the equivalent of carbonic acid being so much lower than the equivalents of potassa and soda, any incorrectness which may occur in estimating the amount of that acid, becomes about half as much again in the case of soda, and about double when potassa is operated on, and this is, and ever must be, a fatal objection to all such methods; and I may add, that in this country we shall rarely meet with balances sensible to $\frac{1}{10}$ of a grain, when loaded with the apparatus contrived by Drs. Will and Fresenius.

It now remains for me to describe the method of testing alkalis which I always employ, which is very simple, and whose indications are delicate and *really worthy of confidence*. Of the existence of this mode of alkalimetry, Drs. Will and Fresenius seem to be quite unaware. I may state, that for some years past, I have put it in practice in the laboratory of Messrs. Hawes, where, from the scientific acquirements of those gentlemen, only such processes as possess intrinsic value will find admission. If it be necessary to say more in its favor before describing it, perhaps it may be as well to add that its use is sanctioned by my highly-talented and respected friend Mr. Lewis Thompson, a contributor to this journal, and that it was employed by the late much-lamented Mr. H. Hennell.

This method consists in preparing a test acid of such strength, that ten grains of it will exactly neutralize one grain of pure soda. I shall enter more fully into the preparation of this acid further on.

Having an accurate test acid prepared, a small bottle is filled with it, and placed in the balance, which is carefully brought to an equilibrium. We then take 100 grains of the alkali, dissolved in distilled water, and decanted, if necessary; the test acid is then gradually added until the alkali is nearly saturated. The solution is then boiled for a few moments, a small quantity of a solution of litmus is dropped in (or test paper may be used, if preferred), and the test acid added until saturation is completely effected. Of course the accuracy with which this is done will depend on the skill of the operator.

There are many good methods of ascertaining whether or not the solution is supersaturated; these will immediately suggest themselves to the mind of the chemist; it is needless, therefore, to detail them; other persons are totally incapable of performing this analysis; consequently, it is not desired to place anything in their hands, as they would only disgrace it and those from whom it emanates.

The bottle which contained the test acid is then returned to the scale in which it was first weighed, and by adding weights we ascertain how much of the acid has been employed to neutralize the alkali in the sample; and as ten grains of the acid are equal to one grain of pure soda, the calculation required is no difficult one.

The analysis may thus be performed with accuracy to the tenth of a grain, or even to a less amount, without the slightest difficulty. Perhaps it may be as well to adduce some evidence of the really extraordinary accuracy of this method; therefore, I subjoin four analyses of samples of alkali, one performed by Mr. L. Thompson, and the others by myself, with test acid prepared by each of us, separately, at different places, and, consequently, with different materials:—

I. According to my analysis.
Alkali ..... 38·6.

According to Mr. L. Thompson.
Alkali ..... 38·5.

First Anlysis.
II. Alkali ..... 42·1.

Second Anaylsis.
Alkali ..... 42·1.

No. II. gives the analyses of two different samples of the same parcel of alkali, sent to me by a merchant, and I made the returns without knowing, until afterwards, that they were from the same parcel. I should also add that the samples were sent two or three weeks apart, and were tested with different batches of test acid.

It once occurred to me to have to test a parcel of soda ash three times, at distant periods, and at different parts of the country: in the first case, I employed an acid which I had prepared nearly two years before; in the second, an acid which I had prepared six months previously; and in the third, an acid hurriedly made on the spot: all these analyses *perfectly coincided*, even to the tenth of a per cent. Is not this sufficient proof of the accuracy of the system? I could cite hundreds more; but I think these will suffice, without uselessly occupying space.

It has been objected to all methods of ascertaining the commercial value of alkalis wherein an acid is used, that such alkalis, and more especially the soda of commerce, contain certain salts of the individual alkalis capable, like the carbonates, of saturating acids, the alkali of which is perfectly useless to the purchaser, not being rendered caustic by the addition of lime; but the only one of these salts which it is necessary to notice is the sulphite of soda.

All this is readily admitted: the soda-ash of commerce contains much sulphite of soda, and the alkali contained in this sulphite is quite valueless to the purchaser. But how stands the matter at present? The sulphite has rarely been allowed for by the manufacturer; in fact, it appears to me that the vender does not really sell by the real quantity of alkali, free and carbonated, which the ash contains, but by the quantity which sulphuric acid will indicate. It must, however, be borne in mind, that I do not for one moment assert that an allowance ought not to be made for the sulphite, as sometimes it may be a mere trace, at others, 3 or 4 per cent.; but the manufacturer has not calculated for its deduction, and such is the depressed state of the alkali trade, that if it were immediately allowed for, little or no profit would be left to the maker, and he would be compelled to raise the price of his article. There can be little doubt but that the purchaser frequently suffers considerable loss from being unacquainted with the fact of the parcels of alkali which he buys containing more than usual of the salt in question, and this loss is the more serious as it undermines him without his knowledge.

Let us here stop to examine the position of the scientific chemist who is called upon to analyse a sample of soda-ash, and I think it will be readily admitted to be a very awkward one on this account, because, if he return an analysis deducting the sulphite, he would subject himself to all manner of unpleasantness; his analysis would indicate one, two, or three per cent. less than that performed at the works at which the ash was manufactured, and by which it is invoiced to the broker in London: the manufacturer would immediately order a sample to be sent to some person "known in the market" (but a complete stranger to science), and in whose analyses I know that no such allowance is ever made. In consequence of this, the chemist would unanimously be voted wrong and ignorant, or, perhaps, suspected of something worse, and the manufacturer would refuse to sell by his analysis in future. Any attempt on the part of the chemist to explain the cause of the difference would in no way improve his position, as in all probability those to whom he had to make the explanation would be utterly unable to understand what he meant by sulphite, and his reason for deducting it, and perhaps regard his explanation merely as subterfuge to palliate ignorance or stupidity. On the other hand, it may and does occur that the alkali falls into the hands of a person who deducts the sulphite: here, again, unpleasantness is produced, and explanations avail not. The question, in England, is altogether in a very awkward position for all parties concerned, and this is in great measure attributable to the ignorance of those to whom the analyses of alkalis have hitherto been confided. When the sulphite is to be allowed for, it should always be distinctly stated, as the analyst is scarcely warranted in making the deduction unless an arrangement to that effect has been made between the buyer and the seller. It is the province of the chemist only to inform them of the facts as they stand, and their interest to make themselves acquainted with them.

It is by no means a difficult task, although, of course, it rather considerably increases the time required for the performance of the analysis, so to execute it, that—although sulphuric acid is used as before described—the alkali which exists in the state of sulphite shall not be reckoned with the other. For the accomplishment of this object, the sulphite is converted into sulphate before the analysis is commenced. This is done by boiling the sample to be tested with chlorate of potassa, and subsequently heating it to redness in order to decompose any superabundance of chlorate, as recommended by Gay-Lussac, or, which is far better, by boiling with peroxide of manganese, allowing the solution to settle, and then proceeding with the analysis. There are other substances

which may also be used for the conversion of the sulphite of soda into sulphate.

I now proceed to the mode of preparing the test acid to be used in the analysis of alkalis.

A quantity of pure sulphuric acid is added to distilled water, so as to form an acid of the specific gravity of about 1·109 when of the same temperature as the atmosphere. This acid is then further corrected by testing its strength with pure anhydrous carbonate of soda;* the accuracy of the acid may be finally determined by chloride of barium. The equivalent of soda is 31·3, and as at the proper strength of the acid 10 grains of it should saturate 1 grain of pure soda, 313 grains of this test acid should contain 40 grains of real sulphuric acid.

If we please, we may prepare a different test acid for analysing potassa, upon exactly the same principles as that just described; or the soda test acid may be used, in which case a simple calculation is subsequently necessary.

The most implicit reliance may be placed in the acid, when prepared by a competent person; it is very stationary, having but slight tendency to part with water in dry weather, or to attract it from a humid atmosphere.

Some time ago much difference of opinion existed among certain persons who considered themselves very capable of forming a judgment on the subject, as to the actual amount of alkali contained in the crystals of soda of commerce, by which standard they prepare their test acid. Some of these sapient gentlemen, in utter contempt of the equivalent of soda, as corrected by *chemists*, insisted upon calculating these crystals as containing 22·2 of real alkali per cent., and on making their analyses in accordance with this erroneous opinion; but let us hope that the remarks which have appeared in this journal† have removed the ignorance, or whatever it was, and that it is unnecessary to say more on this head. If the publicity which this subject acquired did not effect all that could have been been desired, I trust, nay, I know, that it accomplished much.

Although the method of ascertaining the quantity of real alkali in the soda and potassa of commerce, which I have described, is capable, in the hands of the *chemist*, of giving perfectly unexceptionable results, and, in the present day, at any rate, not to be surpassed, nevertheless, it is sometimes useful for the chemist to be possessed of a method by which these results may be corroborated. I have therefore devised the following process:—

I take, say 200 grains of the alkali to be examined, dissolve and decant it, if necessary, to remove the carbonate of lime or other insoluble impurity. The solution is then placed in a Florence flask, an excess of a pure salt of ammonia is added, and the ammonia which is evolved is conducted, by means of a tube fitted in the neck of the flask, into another vessel containing a dilute volatile acid, such as the hydrochloric; sufficient heat to boil the solution is then applied and continued until the ammonia is driven over. The solution of the ammoniacal salt thus formed is then carefully evaporated to dryness, and the amount of alkali is calculated by the quantity of dry ammoniacal salt obtained.

The successful performance of this operation depends merely on a few points which chemists will at once perceive and attend to. These are, that the cork which holds the tube in the Florence flask be quite air-tight, that the ammoniacal salt used be quite neutral, that the acid employed to receive and detain the ammonia contain no fixed impurity, that all the ammonia be driven over, and that the resulting ammoniacal salt be thoroughly dried.

It may not be amiss, before concluding this article, to make some observations on the mode of taking the samples to be analysed.

In all cases, they should be placed in well corked large wide-mouthed bottles. I say wide-mouthed bottles, because the ash sometimes contains large lumps which often slightly differ in strength from the finer portions, and these are frequently thrown aside as being too large to enter the neck of the bottles, and thus the operator gets only the smaller pieces.

Sampling a parcel of alkali consisting sometimes of 40 to 50 casks, and even more, is an operation requiring some time for its performance, and those on whom this duty devolves, as they take the sample from each cask, lay it on a sheet of paper until they have sampled all the casks: now this should in no case be done. As soon as the sample is drawn from each cask, it should be placed in a large bottle, as, if the alkali be strong and contain much in the caustic state, and if the atmosphere be damp, it will, by attract-moisture, and probably a little carbonic acid, lose somewhat in strength. It should afterwards be turned into a large sheet of

* The soda may be prepared by twice re-crystallizing the crystals of carbonate of soda of commerce, in distilled water, and then driving off all the water of crystallization, and finally subjecting the mass to a dull red heat.

† See The Chemist, Vol. III. (1842), pp. 116, 145, and 175.

paper, and must be thoroughly mixed; a portion of this is put into a bottle and sent to the chemist.

In every case, at least two-thirds of the casks should be sampled, and if any cask differ in appearance, from humidity or otherwise, it ought to be separately sampled, as sometimes a cask will accidentally become damaged, or a cask of weak alkali may be sent by mistake with a number of casks of strong alkali.

The samples should always be drawn from as near the centre of the cask as possible.

The manufacturers of soda ash place it under a shed immediately after it is removed from the evaporating pans, until they have collected enough to make a parcel, and sometimes it is packed into casks while still hot, which ought never to be done, as it causes the ash to set so hard as to render it almost a matter of impossibility to take samples by the ordinary means.

It also frequently occurs that the person who assays soda ash at the works where it is manufactured, performs this operation while it is yet warm; a practice which should ever be avoided, and which is sure to cause disputes, as the alkali always tests from one to two per cent. stronger, under these circumstances, than when it has become thoroughly cold, owing to its having attracted moisture in the latter case.

In concluding this portion of the subject which I have undertaken to illustrate, it may be well to remark that the analysis of alkalis, in this country, frequently falls into very unskilful and unscientific hands. It is a common error for people to imagine that if a system be good and simple, little depends on the operator, and that practice will ensure proficiency; this, to a certain extent, may be true, as regards some things; but with relation to the successful performance of chemical analysis, it is very far from correct. It requires a peculiar frame of mind to be a successful analyst, as well as an amount of patience and love of truth by no means natural to all men. The analysis of alkali requires as good a chemist for its proper performance as many much more complicated bodies. It is not sufficient that a man knows that a certain proportion of sulphuric acid will saturate a given quantity of soda or potassa, or that he be capable of dropping into his test acid a certain *little glass bead*, constructed for the purpose by an individual exhibiting thereby a lamentable deficiency of practical knowledge of the subject; the man whose mind is satisfied with such a limited amount of knowledge as this, and who fancies that a more extended acquaintance with the subject, and a knowledge of the laws of which it forms an example, would be superfluous, far from being deserving of confidence, should be carefully avoided. It is such persons as these who call improvement innovation, and who, because they cannot keep pace with the rapid strides of science, wish others to halt on their road, and who satisfy themselves by saying "our forefathers did it so and so, and in their day gave satisfaction."

I intend next month to enter into the very important subject of acidimetry, and I shall feel obliged by any communications or suggestions which the readers of this journal may be able to favor me with, on any of the subjects I have taken up.

ELECTRO-LACE.

BY MR. JOHN A. PHILLIPS.

Electro-lace is made by stretching common net on a frame of stout copper wire, and then brushing it over with plumbago until its surface has acquired a uniformly black color. It is then connected with the negative pole of a galvanic battery, and subjected to the voltaïc action between two plates of copper positively electrified, which causes it to be rapidly and effectually coated with metal, each thread being enclosed in a tube of copper.

When it is desired that the sheets of lace be of large size (several feet square, for instance), it will be necessary to divide the large frame by fine wires into squares of seven or eight inches, which, forming nuclei for the deposit of metal, enables the sheets to be made of any extent, and at the same time tends to strengthen the work.

The uses of electro-lace are similar to those of common wire gauze, but when silvered or gilt it forms a beautiful material for fancy work.

The author has also constructed a voltaïc battery of electro-lace, which, from the numerous points its surface presents, is presumed to be superior to the wire gauze employed in the common gauze battery.

Mr. Phillips has also brought forward a plate for the negative element of a voltaïc battery, which being made of linen coated with copper, and afterwards silvered and platinized, afforded, from its greater roughness, a superior surface to that of the plates in common use. This process was also stated to be applicable to the coating of ropes with copper, as lightning conductors for ships, considerable superficies with little weight of metal being thereby obtained.

THE OPERATION OF EXCISE RESTRICTIONS UPON THE PROGRESS OF CHEMICAL SCIENCE, AS APPLIED TO THE ARTS AND MANUFACTURES OF THIS COUNTRY.

LETTER II.

To the Editors of The Chemist.

GENTLEMEN,—

THE favorable reception of the letter I addressed to you last month, induces me again to trespass on your columns, and to enter upon the subject I propose to consider, viz., the injurious effect of excise laws upon manufactures the improvement in, and successful prosecution of which depend upon a knowledge of chemistry.

I might with safety rest the proof of my case on a comparison of the present state of a few of our most important manufactures which have never been under the Excise—such as iron, pottery, alkali, cotton, silk, &c., with those, which, from the reign of Queen Anne to the present day, have been fettered and restricted by the withering influence of Excise regulations, viz., glass, paper, soap, &c.; but I know that the advocates of this system of taxation—the system of indirect taxation—when considering the subject, are apt to fancy that the improvements so rapidly introduced into some manufactures, and the inactivity of others, depend, not so much on the effect of these fiscal regulations, as upon the superior intelligence of one set of manufacturers over others.

This view is so manifestly unsound, that had not custom and habit inured us to the system of interference imposed by the Excise Laws, no one would for a moment tolerate it; but, as use becomes second nature, so has the long existence of these laws caused them to be viewed as machinery incidental to a profitable source of taxation, thereby throwing out of view their immoral influence on manufacturers and their baneful effect on the talent and industry of the country.

For a few years it appeared as if a more rational view of the subject had gained ascendancy in the minds of our Chancellors of the Exchequer, for from 1830 to 1833 the Excise duties on beer, candles, printed cottons, tiles and starch were repealed, and the Excise machinery thereby destroyed; whereas, since that time, by reducing the taxes on glass, paper, and soap, all the interference and restrictive machinery is retained for a smaller amount of revenue.

Now, had one of these taxes been repealed, instead of all being reduced, an advance in the right direction would have been made, and far greater good would have been done than by the half-and-half measures which have been adopted, and one more manufacture would have been relieved from this most vexatious interference.

Two conditions appear essential to the perfection of improvements in manufactures, whether chemical or mechanical. First, the possession of knowledge; and secondly, security, that, when knowledge has been practically and usefully applied, the benefits arising therefrom will be enjoyed by its possessors.

The patent law professes to secure this, and offers, no doubt, in the opinion of the public, ample protection to the inventor, for the time, talent and industry he has devoted to his subject.

Inventions relating to manufactures, especially chemical inventions or improvements, are generally the result of minute observations made during the progress of the ordinary business of the manufacture to which they relate. In those works where the exciseman is unknown, improved results may be obtained by slight variation of apparatus, or in the mode of working, known only to the inventor, and the profit derived therefrom may be retained for years; but, where every operation is watched by the Excise, the form of the apparatus limited, and the assent of the Commissioners required, even for a trivial alteration, before it can be adopted; what chance has a manufacturer of retaining advantages arising from his industry and skill, and which ought to be as strictly protected as any other property in the kingdom?

Although these regulations deprive many of the just fruits of their toil, still there is always some one sanguine enough to attempt to introduce improvements, the initiative experiments for which, to avoid the observation of the Excise, are generally made in secret, and with very imperfect apparatus, thereby always exposing the experimentalist to the risk of Excise informations—for the intelligent and honest trader, writhing under these odious regulations, and striving to protect himself from their injustice, is a far better victim than one of the hundred dealers in fraud encouraged by such laws, and whose profits are too often participated in by those whose petty tyranny would enjoy a triumph over talent and honesty.

The natural consequence of experiments made under such disadvantages is, that the results are often guessed at, and, in the ardor of imagined success, a patent is obtained to protect an *idea* rather than well-ascertained results, in order that the inventor may enjoy the privilege of making in safety

practical experiments in his own manufactory and with his own apparatus.

As must be expected, such patents are generally failures; manufacturers become disgusted, and having once or twice perhaps wasted their time and money, laugh at science and chemistry, treat experimental chemists as charlatans, and listen to them only when they offer to give their information for nothing, for there is no security that industry and talent, or expenditure of time and money, will meet its due reward, when applied to those arts and manufactures which are under the peculiar care and guidance of Her Majesty's Board of Excise.

In my next letter I will illustrate my views by referring your readers to the present state of various important manufactures, confining myself at first to those in which a knowledge of chemistry is of essential importance.

I am,
Gentlemen,
Your obedient servant,
H.

ON THE DISCOLORATION, BY MEANS OF ELECTRICITY, OF PAPERS SENSITIVE TO LIGHT, AND ON A NEW CLASS OF ELECTRIC PICTURES, OR ELECTROGRAPHS.*

BY M. AUG. PINAUD.

The object of this inquiry is to study the action of static-electricity on the chloride, the iodide, and the bromide of silver, and to compare it with that of light on the same substances.

I at first employed Daguerréotype plates, iodized or bromized. On throwing electricity on to one of these plates, from a point, whether it were positive or negative, I obtained in a very few moments brilliant spots of the bluish colour of steel, which were tinted at the edges. By this means, all sorts of figures or sketches can be traced. The discharge of a Leyden jar instantly forms circular spots of perfect regularity, presenting a very great analogy to those which Priestley obtained by means of powerful batteries on metallic surfaces merely polished.

Each of these modes of experiment was inefficient for the object I had proposed; for, independently of Priestley's experiment, M. Matteucci had recently shown that a series of sparks, falling on the silvered surface of a Daguerréotype plate, *eventually* produces a bluish tinted spot. It is true that the electricity acts on the silver much more promptly when the surface of the metal has been previously iodized; but this distinction may be regarded as illusory.

I have, in fact, proved, that the action of very little sparks on silver plate is *instantaneous;* and that the spots which they form, although they be not immediately visible, do nevertheless exist from the very first moment. In order to alter the metallic surface, there is no need to prolong the current of sparks, as M. Matteucci did; an instantaneous escape of electricity, without visibly affecting the metal, developes on its surface a deep and lasting alteration, which is rendered evident as soon as a moist puff of breath has been directed upon the plate. The vapor condenses around the part which has received the electricity, and tarnishes the metallic surface; but the points, which have been acted on by the electric fluid, remain brilliant, and seem moistened by a transparent film of water. These points, therefore, possess the property of condensing vapor differently from the others. In this fact, there is an analogy, not hitherto noticed, with Moser's images.

Renouncing metallic iodized plates, I was led to examine the action of electricity on photographic papers. Their electric sensibility is extreme.

I take a sheet of paper, having a uniform coating of *bromide of silver*, and which is very dry. After having placed or pasted it on an insulated metallic plate, connected with the conductor of the electrical machine, a very fine metallic point, which is held in the hand, and *electrized negatively by induction*, is presented to the electrized paper, at a distance of one or two millimètres. Opposite to the point, there is immediately formed a round spot of blackish brown color, which follows all its movements, and which may be extended at pleasure. The discoloration thus obtained has a deep brown shade, like that generated by light; and producing, when the point is slowly moved, the effect of an artist's stump. The experiment succeeds very well with a little bundle of fine platinum wires, tied to a metal handle.

The metallic point may also be placed *in contact* with the paper, and be passed gently along its surface; the discoloration is is then deep black, limited to the points which are touched, and the effect is that of a drawing pencil.... To prevent the point's tearing the paper, a wire is secured in the axis of a glass capillary tube, the lower extremity of which is melted in order to produce adhesion; and the protruding part of the wire

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Comptes Rendus, and *Electrical Magazine*.

is cut off; the tube and the point then pass freely along the paper.

The experiment does not succeed when the paper is slightly moist.

The bromide of silver, which is so sensitive to negative electricity, does not undergo any *apparent* alteration when exposed to the stream of positive electricity which flows from a point attached to the conductor of the electrical machine.

I finally proved that the influence of electricity takes place, in perfect darkness, upon papers which have been prepared during the night; and that, consequently, it is totally independent of all previous or simultaneous action of luminous rays.

Papers prepared with nitrate of silver only, or with chloride of silver, have little electric sensibility. Papers covered with iodide of silver, which are but little sensitive to the action of light, are, on the contrary, very sensitive to the electric fluid. They present, beyond the others, this peculiarity, that they are affected, in a different manner, it is true, both by the electricity from a positive point, and by that from a negative. The negative fluid forms a roundish black spot; the positive fluid developes, in all the filaments of the paper among which it is diffused, a violet discoloration in a radiated form.

This double phenomenon is due to the decomposition of the iodide of silver. The iodine is determined to the positive point, and produces the violet color; the reduced silver is determined at the other point, and causes the black spot. To a decomposition of the same kind must also be attributed the action of electricity on papers prepared with bromide of silver; and if, in this case, no sensible discoloration is manifested about the positive point, it is because the bromine, which is liberated there, disappears, on account of its great volatility.

The following curious experiment has confirmed me in this idea. I exposed a paper prepared with bromide to the direct action of the solar rays until its tint became as deep as possible; I then subjected it to the action of two metallic points, one connected with the conductor of the machine, the other with the earth. The slate-colored shade of the paper immediately became black around the negative point, and formed a rounded spot; while, opposite to the positive point, there appeared a kind of star, which was white, and very delicate, and indicating, by its ramifications, the radiating distribution of the vitreous electricity on the surface of the fibres of paper. On reversing the order of the connections, and making the vitreous fluid pass to the black spot, and the resinous to the white star, the latter became black, and the former white. A fact worthy of observation is, that light acts very slowly on the white stars produced by the positive electricity, and that an exposure of more than three hours to the direct rays of the sun, although reducing their brilliancy, was not sufficient to obliterate entirely all traces of them.

In the last place, I investigated, in my memoir, the action which the discharge of the Leyden jar exercises on photographic papers.

On making the experiment of piercing paper, the paper is perforated, and, on the bromized side, the hole is surrounded by a brown halo, which has the same appearance, whether the positive or negative coating is presented to it. This discoloration, produced indifferently by either coating of the Leyden jar, appears to me a new confirmation of the principle, that electricity is transmitted by a molecular vibratory motion, and not by a motion of transfer. In support of this principle, another and a more remarkable fact of discoloration, obtained on photographic papers, by the spark of the condenser, is as follows:—Instead of passing the discharge through the paper by means of two opposed metallic points, I made it pass over its surface, by placing the two points of a universal discharger in contact with the prepared surface. The paper must be dry, and be supported on an insulated stand. The spark of a highly charged jar is passed, from point to point, along a distance of four, five, and even six centimètres, and the trace of this spark is instantly impressed upon the paper, by a redish train, which records all its windings and sinuosities, and which resembles an actual scratch. It appears to me an interesting circumstance thus to have obtained, notwithstanding the very fugitive character of its appearance, the form of electric spark, so capriciously broken as it is, traced out by itself.... Another infallible mode of succeeding, is to place the paper vertically between the two points, one above, the other below, at several centimètres apart. The electric fluid glides over the paper, it pierces it on the level of the negative point, and leaves on its surface a long sinuous train. On making the experiment in vacuo, a much wider spot is obtained, but it is scarcely visible, on account of the diffusion which the electric fluid acquires.

From what has preceded, may be deduced an equally simple and infallible means of obtaining electric pictures, which I call *Electrographs*. The principle consists in multiplying the number of sparks, which impinge upon the surface of the photographic paper, following the form of a design, in order to multiply the spots which are produced. For example, on the surface of a spotted-plate,

I place a sheet of *dry* paper, prepared with bromide or iodide of silver, and I retain it by means of a glass plate slightly pressed against it. I then pass the discharge of a powerful Leyden jar along the metallic ribbon; each solution of continuity is marked by a spark; and spots are formed on the paper at all the corresponding points. A very exact representation of the design which is traced on the plate, is thus obtained.

The impression of electric sparks produced with all their sinuosities, the new system of electrographs which are the result, and the rapid discoloration of sensitive papers by the electric fluid, which passes from a point, are experiments which appear to me deserving henceforth of a place in the series.

MEMOIR ON THE DISTRIBUTION OR APPROPRIATION OF LANDS.*

BY PROFESSOR LIEBIG.

(Continued from page 30.)

We cannot believe in the possibility of the formation of blood in the body of an animal, or of milk in that of a cow, if there be wanting in their food one of the principles which should be regarded as conditions of equal necessity for the sustenance of all the vital functions.

The sulphuro-nitrogenous substances, as well as the alkalis and the phosphates, are principles of the blood; we cannot conceive the passage of the former into this fluid without the presence and concurrence of the latter.

The faculty possessed by a portion of the plant of sustaining the life of an animal, and of increasing the mass of its blood and flesh, is, then, in direct ratio with its richness in the organic principles of the blood and with the quantity of alkalis, phosphates and metallic chlorides (chlorides of sodium or potassium) necessary to their passage into the blood.

It certainly is a highly remarkable fact, and of great value to agriculture, that the sulphuro-nitrogenous vegetable substances, which we have designated as organic principles of the blood, are, in all the parts of plants in which they are found, always accompanied by alkalis and phosphates.

In the juice of potatoes and of beetroots the vegetable albumen is accompanied by alkaline salts and soluble phosphate of magnesia; we have in the seeds of peas, lentils and beans, and in those of cereals, alkaline phosphates and earthy salts.

The seeds and fruits in which the organic principles of the blood are found in greater abundance, contain also a predominating quantity of the inorganic principles, the alkalis and phosphates; and in the other substances, such as potatoes and roots, which are proportionally so poor in the former, the latter exist also in a much smaller quantity.

The simultaneous presence of the two classes of combinations is so constant, that an intimate connection cannot be doubted. It is extremely probable that the production and formation of the organic principles of the blood in the organism of the plant are connected by the strongest ties with the presence of the alkalis and phosphates.

We should suppose that even with the introduction of the greatest quantity of carbonic acid, of ammonia and of the sulphates, which furnish the sulphur, the organic principles of plants would not be produced in the form appropriate to their conversion into blood, if the alkalis and phosphates by which we always find them accompanied were wanting.

But even admitting that they might also be produced in the organism of the plant, without the concurrence of these substances, they could not be converted in the body of the animal into either blood or flesh, if the mineral principles of the blood were wanting in the part of the plant given as food.

Apart from all theoretical considerations, the judicious agriculturist should then, with relation to the objects he has in view, proceed precisely as if the production of the organic principles depended on the presence of the inorganic principles of the blood (the phosphates and the alkalis); he should give his plants all the principles necessary to the formation of the leaves, stems, and seeds; and if he wish to attain on his fields a maximum of blood and flesh, he should add in greater quantity those of their principles which the air cannot furnish.

Starch, sugar, and gum contain carbon and the elements of water: they are never found associated with the alkalis; they do not contain phosphates. It may be believed that in two varieties of the same plant, by the addition of an equal quantity of the mineral elements, very unequal quantities of starch or sugar are formed, that from two equal surfaces of land prepared in precisely the same manner, and sowed with two varieties of barley, we might collect on one, one-and-a-half, or even twice, the weight of seeds on the other; but this excess of product can have relation only to their non-nitrogenous, and not to their sulphuro-nitrogenous principles: for

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* *Annalen der Chemie und Pharmacie.*

an equal quantity of the inorganic principles of the blood added to the soil and passed into the plant, there should be formed in the seeds a quantity of organic principles which corresponds to them; in short, it cannot be found more in one than in the other.

It will be only the introduction of a less quantity of nitrogen into a plant during the lapse of time given, which will produce a difference: it will be owing to the want of ammonia that a corresponding quantity of the inorganic principles of the blood will not find employment.

Of two kinds of different plants which we cultivate on a field of the same nature, that one will remove from the soil the greatest quantity of the inorganic principles of the blood (phosphates), in the organism of which will be produced the greatest quantity of the organic principles of that fluid (sulphuro-nitrogenous compounds).

One of the plants will exhaust the ground of these principles, whilst with the same conditions of culture for the other, which has removed from it a smaller quantity of phosphates, it will still remain fertile for a third kind of plant.

This is, therefore, the reason why with the development of certain parts of plants which, such as the seeds, much exceed all the others in their richness in the organic principles of the blood, the soil loses much more of the phosphates, and is exhausted much more than by the culture of herbaceous plants, or of tubercles and roots which contain very little of them in proportion.

Besides, it is clear that if two plants which require in equal times the same quantity of the same principles grow side by side on the same ground, they will partake the principles of the latter. That which one of them introduces into its organism, the other cannot appropriate.

If the soil on a limited space (surface and depth) contain not more of these inorganic aliments than ten plants require for their complete development, twenty of the same plants cultivated on the same surface will attain only half their development; the number of their leaves, the strength of their stems, and the number of seeds should present a difference.

Two plants of the same nature should be reciprocally injured, if grown within a certain distance they find in the ground or in the atmosphere which surrounds them a less quantity of the aliments which are necessary for them, than they require for their complete development. There is no plant more injurious in this manner to a plant of wheat than a second plant of wheat, or to a potato plant than another potato plant. We find, indeed, that cultivated plants greatly excel at the border of the fields, in strength and in number of seeds and tubercles, those which grow in the middle.

But the same case should be reproduced, in a perfectly similar manner, if we cultivate the same plant no longer by the side of the other, but one after the other during several years on the same soil. Let us admit that the soil contains a quantity of silicates and phosphates sufficient for 1,000 crops of wheat, it will be sterile for the same kind of plants after 1,000 years. Let us represent the surface of this field as exhausted to the bottom which nourished the roots of the plants of the first crops; let us replace the bottom by the surface, and the surface by the bottom, and we then have a new surface, which, being much less exhausted, again ensures us a series of crops: but this state of fertility also has limits.

The less rich the soil is in these mineral aliments, so indispensable to plants, the sooner will the period of exhaustion arrive; but it is clear that we restore it to its primitive state of fertility by reëstablishing its original composition, and, consequently, by returning to it the principles which we had reaped and removed in the plants.

Two plants may be cultivated side by side, or one after the other, if they require unequal quantities of the same principles in unequal times; they will not be injured, and their vegetation will be beautiful, notwithstanding their proximity, if they require for their development different principles of the soil.

The investigations of M. de Saussure and many other naturalists have shown that the seeds of the *Vicia faba*, of the *Phaseolus vulgaris*, of peas and of garden cress (*lepidium sativum*), germinate and are developed to a certain degree in wet sand, and in horse-hair kept in a state of humidity; but when the mineral substances contained in the seed are no longer sufficient for the further development of these plants, they begin to droop; they sometimes flower, but they never produce seeds.

Wiegmann and Polstorff made plants of different kinds vegetate in white sand boiled with aqua regiâ and freed from acid by careful washing;* barley and oats sown in this

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* This sand contained in 1,000 parts:

Silica	979·00
Potassa	3·20
Alumina	8·76
Peroxide of iron	3·15
Lime	4·84
Magnesia	0·09

sand, and sufficiently moistened with water free from ammonia, reached the height of 0m487 ; they flowered, but produced no seeds, and perished after flowering. The *Vicia sativa* attained the height of 0m27, flowered, and produced husks ; but they contained no seed.

Tobacco sowed in this land presented a perfectly normal development; but from June to October, the little plants attained only the height of 0m14 : they had only four leaves without stalks.

The examination of the ash of these plants, as well as the analysis of the seeds, showed that this land, sterile as it was by itself, and poor as it was in potassa and soluble principles, nevertheless yielded to them a certain quantity of these substances which had served for the development of the stalks and leaves. But these plants could not bear seed, because evidently there was a complete absence of the substances necessary for the formation of the principles of the seeds.

In the ash of most of the plants grown in this sand, might the presence of phosphoric acid be demonstrated ; but it corresponded only to the quantity of that acid introduced into the soil by the seed. In the ash of tobacco, whose seeds are, as is known, so small that the phosphoric acid which they contain eludes analysis, it was impossible to detect any trace of it.

Wiegmann and Polstorf demonstrated the accuracy of the theoretical opinions relative to the cause of the sterility of this sand. They took the same sand, and prepared with it, by the addition of salts obtained in a purely artificial manner in a laboratory, a soil likewise artificial ; they sowed in it the same plants, and found them to thrive in it very well. The tobacco shot forth a stem more than a metre in height, and many leaves ; it flowered on the 25th June, produced seeds about the 10th August, and on the 8th September ripe capsules were collected with perfectly developed seeds.

Barley, oats, buck-wheat, and clover were developed in a perfectly similar manner : they all came up well ; they flowered and produced ripe and perfect seeds.

It is quite certain that the fine vegetation of these plants in this sand, previously quite barren, depended on the salts added. This artificial soil owed its equal fertility for all these plants to the addition of certain substances whose presence might be demonstrated in the perfectly developed plant, in the stem, leaves and seeds, and whose existence in the soil and in the vegetables puts beyond doubt their necessity for the life of the plant.

We can, therefore, give to the most barren soil the greatest fertility for every kind of plants, by furnishing to it the principles which are necessary for their development. In fact, to endeavor to render fertile, according to these principles, a completely barren sand, requires neither trouble nor expense ; but by applying them to our ordinary lands of culture, which already contain in themselves a great number of these substances, it is sufficient to furnish those which are wanting, to increase those which are found in them in too small quantity, and to give to the soil, by the art of agriculture, the physical properties which render it permeable to the humidity of the air, and permit plants to appropriate these principles of the soil.

Different kinds of plants require for their vegetation and complete development the same inorganic aliments, but in unequal quantity or unequal times ; or else they require different mineral substances. It is to the difference of the aliments necessary to their development which the soil presents, that it must be attributed, if certain kinds of plants growing side by side are mutually arrested in their development ; and if others, on the contrary, in the same condition, present a rich vegetation.

If, indeed, we compare the principles of the ash of the same plant which is developed in different soils, we find only very slight differences in its composition. We have, as an invariable principle, in the straw of the graminaceæ, silicic acid and potassa, and in their seed phosphates of potassa and magnesia ; in the straw of peas, and in clover, an abundant quantity of lime is found. We know, besides, that in certain kinds of plants, potassa may be replaced by soda, and lime by magnesia.

It results, moreover, from the investigations of M. Boussingault (*Annales de Chimie et de Physique*, 3e Série, t. i. p. 242), that on an equal surface (1 acres (?)) of the same field manured once, there will be removed from the soil, by five successive crops :—

			Principles of the soil.
1st year, by a crop of		potatoes (tubercles without stalks or leaves)	246·8 lb.
2nd ,,	,,	wheat (straw and grain)	371·0 ,,
3rd ,,	,,	clover	620·0 ,,
4th	,,	wheat*	488·0 ,,
	,,	peeled turnips	108·8 ,,

* In a second and third *assolement*.

	Principles of the soil.
5th year, by a crop of oats (straw and grain).....	215·0 lb.
By a crop of beet-roots* (roots without leaves).....	399·6 ,,
,, peas (seeds and straw)	618·0 ,,
,, rye.....	284·6 ,,
,, artichokes (hel. tuberosus).....	660·0 ,,

Of these numbers, which express the quantities of inorganic substances extracted from the same soil by different plants, and extracted or removed consequently in the crop, it results that different plants introduce into their organism unequal weights of these principles of the soil.

The attentive examination of the principles of their ashes shows, moreover, that they differ essentially with respect to their quality. 1000 parts of beetroots, potatoes, or turnips, leave, by cultivation in the dry state, 90 parts of easily fusible ash, containing a great quantity of carbonate of potassa and salts, with alkaline bases. Of these 90 parts, 75 dissolve in cold water.

2000 parts of dried fern likewise give 90 parts of ash; but of these 90 parts, nothing dissolves in water, or only a trace is dissolved. (Berthier).

It is the same with the ash of wheat straw, and those of barley, peas, beans, tobacco, &c. With equal weights of their ash, very unequal quantities of its principles dissolve in water. Some ashes are completely soluble in water; some are only half soluble in it; and again others contain only traces of principles soluble in water.

If we pour an acid, hydrochloric acid, for example, on the portions of ashes insoluble in water, we find that with a great number of plants, the residue left by the water is completely soluble in the acids (beetroots, potatoes, turnips, &c.); that with others, only half of these residues are dissolved in the acid, whilst the other half finally resists; that with others only one-third, or less, is dissolved.

The principles of the ashes of plants which are soluble in cold water, are formed, without exception, of *salts with alkaline bases* (*potassa* and *soda*); those soluble in the acids, are *salts of lime and magnesia*. The residue insoluble in the acids is *silica*.

The unequal proportion of these principles, which are so different in their mode of acting with water and the acid, enables us to divide plants in culture into *plants containing potassa*, which contain more than half their weight of soluble alkaline salts; into *plants containing lime*, in which the calcareous salts predominate; and into *plants containing silica*, in which there is a predominance of silica. These are precisely the principles which are necessary to them in very great quantity for their development, and which essentially distinguish them from each other.

(*To be continued.*)

* In the quinquennial crop above referred to, wheat is mentioned twice. In the second year, by a crop of wheat, 371 lbs., and in the fourth year, 488 lbs. of inorganic principles were removed from the soil. This difference is owing to the unequal quantity of straw and grain which were collected in these two years. In the one, the combined weight of the straw and the grain was 8,790 lbs.; and in the other, on the contrary, 10,858. The relative proportion of these ashes was absolutely the same as these numbers.

EXPERIMENTS WITH MANURES.*

BY W. MILES, ESQ., M.P.

The following statement of experiments, made by himself, on the effect of various manures, was made by W. Miles, Esq., M.P., at a late meeting of the Bristol Agricultural Society:—

"I have endeavored since I last met you to carry out the objects of the society; and I have now to give you the results of the experimonts I have tried this year. They are interesting—as showing, that whilst certain manures are worse than useless, others are very productive. I have always advised that these experiments should be made by the landlord; and I wish to bring the trials I have made in such a shape before you, that you may judge for yourselves if they will be profitable or not to the tenant farmer. If they have been profitable with me, they are likely to be more so to the farmer, who can give that personal attention and overlooking which I have not been able to do. On wheat I have made two trials; and on Swede turnips, six. With regard to the last I am happy to say that I have been unlike my neighbors. In the Swedes, of the first sowing every one came up; the fly did not affect them at all, and they were pulled and topped on the 1st of December. The

* *Morning Post*, January 19, 1844.

different manures I used were Daniell's; common yard dung, mixed with Daniell's; common manure; bones 20½ bushels per acre; Guano, 3 cwt., mixed with 16 bushels of ashes, and Stott's salts, 126 lbs., or 2½ bushels mixed with 11 bushels of screened ashes. I may first state that the soil was a remarkably fine loam, abutting on mountain limestone. It was snb-soiled last year, when I grew wheat on it, having had it manured with ten bushels of bones per acre; so that now you know its condition. I found that Daniell's manure (of which 40 lbs of No. B. was sown broadcast, and ploughed in, and with the seed 12 bnshels of No. A. drilled in before the seed, making 52 bushels) produced 15 tons 5 ewt., at a cost of £1 19s. The next trial was with 10 tons of stable manure, mixed with 60 bushels of Daniell's B manure; that produced 19 tons 18 ewt., at a cost of £3 10s. The next was 20 tons of common manure, which produced 21 tons, at a cost of £5. The next experiment was with 20 bushels of bone manure, which produced 18 tons 4 cwt., at a cost of £2 15s. I then came to the guano, and I used 3 cwt., mixed with 15 bushels of ashes. I have been very careful in endeavoring to collect correct results of the use of guano. I have always had a strong opinion of its utility; and not wishing to give you a merely isolated fact, I have obtained from different friends, what are their sentiments, and I have not heard one dissentient opinion as to its excellence. Every person to whom I have applied, north or south, state that they have always found its use attended with beneficial results.—(Hear, hear.) I will now tell you the result of my trial: it produced 22 tons 18 cwt,, at a cost of £2 2s. 3d. The guano was drilled in before the seed. I now come to another manure which has been but little-heard of—I mean Stott's salts. Of all the modest-minded men I ever knew, I never found one more so than our fellow-eitizen, Mr. Stott. Eighteen months ago I had some correspondenee with him, and he stated that from attending the Royal Agricultural Meeting, and reading Liebig, his attention had been turned to the subject, and he had invented a salt which he thought would be a good manure. He sent me some, and I was most anxious that before it was brought out it should be fairly tested. This is the result upon the turnips, and after a top soluble dressing, 1 cwt. and 26lbs., mixed with eleven bushels of skreened. ashes, produced 17 tons 12 ewt. at a eost of £1 16s. 4d. Sueh have been the results of the experiments I made on the turnips. I may mention that they were tried on a six-acre piece of ground, marked out into six portions. I will now go into spring wheat, so that next year we shall be able to tell how the manures carry out a seeond erop. There are many manures which stimulate a good deal at first, but afterwards become inefficient. We know that it is not the case with dung and bones, so that by them we can test these other manures. So much for the turnips. We will next go to the wheat experiment; and I will take you to a field whieh underwent two processes. It is a field of 8 acres and a half. I was very anxious to give to Daniell's manure a fair trial, beeause of my knowledge of Mr. Wilkins, and also that so much had been said about it. Last year I tried it, and it was a perfeet failure; but that might have been from partieular eireumstanees, and so I was willing this year to give it another trial, putting in precisely the quantity the patentee recommended, and testing it against other manure, which eost me at Shirehampton the samc price as Daniell's cost me at Bristol. I tested it against Bristol ashes. The field was a clover ley, and in this plaee (four acres) forty bushels of Daniell's manure was laid in per acre before ploughing. On the rest of the field thirteen and a half tons of Bristol ashes were put on, at a eost of £1 10s. per acre. On reaping, the produce was less than expeeted—Daniell's manure produced 23 bushels 6 pecks, head; 1 bushel, 11 pecks, tail; and 1 ton straw; the Bristol ashes gave 30 bushels head; 1 bushel 2 peeks, tail; and 1 ton 15 ewt. straw. Daniell's manure has therefore been fairly tested, and I am able to say, that neither as regards turnips or wheat ean I recommend it to the practical renting farmer. Mr. Miles then went on to detail another experiment he had made with Stott's salts, upon wheat, at the rate of 600 gallons per acre, 1 pound of salt being dissolved in a gallon of water. The result was a product of 35 bushels 2 peeks head, 1 bushel 1 peek tail, and 2 tons 5 ewt. straw; the weight per bushel was 59¾lbs. I would now direct your attention to the value of liquid manures, which too many farmers suffer to turn into their roads on ponds. In liquid manures was to be found the essence of everything that was good, and it produced a most luxuriant vegetation. I hold in my hand a statement of the results of some experiments made by Sir C. Lemon in Cornwall, but I think Sir Charles' experiments were conducted on too minute a seale; never less than an acre should be experimented on, otherwise they should only have garden cultivation: the experiment was made with nitrate of soda, sulphate of soda, guano, sulphate of ammonia, Stott's soluble manure, and wash from the farm-yard, which latter

was procured almost for nothing, as the only expense attending it was the building a tank for its reception. The results of these trials were, that on nitrate of soda there was a loss per acre of £3 4s., on sulphate of soda 15s., on sulphate of ammonia of 9s. 3d. There was a gain on guano of £1, on Stott's salt of 16s., and on wash from the farm-yard of £2 10s.

EXPERIMENTS ON THE FERTILIZATION OF LANDS BY AMMONIACAL SALTS, NITRATES AND OTHER COMPOUNDS.*

BY M. F. KUHLMANN.

HAVING been for some years engaged in agricultural experiments, I have made numerous investigations to ascertain to what point agriculture may find in the ammoniacal products useful and economical auxiliaries.

My experiments of 1841 and 1842 had convinced me of the great efficacy of these salts for accelerating vegetation, and I supposed that the facts observed were so conformable to the opinions of chemists, that their publication did not appear to me to possess sufficient interest for science; in fact, they did but confirm the application of the principles laid down in the memoir of MM. Boussingault and Payen (See THE CHEMIST, Vol. IV. (I. New Series), 1843,) as regards manures, and supported the opinion concerning the influence of ammoniacal salts spread in the air, according to one of the prepositions enunciated by M. Boussingault, at the end of his memoir on the absorption of the nitrogen of the air by plants (*Annales de Chimie et de Physique, t. LXIX. p.* 353, *Anno* 1838), a proposition which, in consequence of the observation of Professor Liebig concerning the existence of ammonia, or of ammoniacal salts in the air, could not leave much doubt in the minds of chemists.

Such was my position in the question, when, at its sitting of January 30, 1843, M. Bouchardat communicated to the Academy of Sciences a memoir on the influence of ammoniacal compounds on vegetation, in which the author arrives at the following conclusions:—

I. The following solutions of ammoniacal salts—sesquicarbonate, bicarbonate, hydrochlorate, nitrate and sulphate of ammonia, do not furnish to vegetables the nitrogen which they assimilate.

II. When these solutions containing $\frac{1}{1000}$ are absorbed by the roots of plants, they act just like energetic poisons.

* *Comptes Rendus*, No. XX., 2e Sem. 1843.

These conclusions, so little in accordance with the facts which were produced under my eyes, and with the results of experiments twice reproduced, and on a large scale, induced me to repeat my experiments in 1843; and as the very positive conclusions at which M. Bouchardat had arrived might have the result of causing the abandonment of all experiments on the action of ammoniacal salts in the fertilization of lands, I decided on presenting to the Academy a summary of my new observations, which only confirm my former results, and which appear to me of a nature to remove all uncertainty.

It appears to me that well observed facts cannot be too carefully collected, when it is required to found on rational bases the practices of agriculture. These observations, requiring whole years, cannot be so easily multiplied as those which relate to other branches of human knowledge. My experiments have not been limited to the action of ammoniacal salts; I have investigated the action of nitrate of soda; I have compared the results obtained by these various salts, employed as manures, with the action of a gelatinous solution, with that of the urine of the horse, and with that of Flemish manure.

I selected for my experiments a vast meadow, the whole of whose surface was in the same conditions of exposure and fertility.

By taking the production of hay as an example, I thought to place myself in conditions in which the cares of culture could not influence the results. Each experiment was made on a surface of three *ares*,* and from distance to distance, between the slips of land experimented on, a slip was left without manure, in order to allow of the results produced being properly appreciated. The slips were separated from one another by trenches.

All the manures were dissolved or suspended in water, in such a manner as to present a volume of 975 litres or 325 hectolitres per hectare.† The irrigation was performed on the 28th of March, 1843, in very dry weather; on the 30th, a heavy rain fell, and the weather remained wet until the 5th of April, so that the manures were uniformly spread. The season was very rainy; the crop was made on the 30th of June; the whole was mowed the same day, and the weather was favorable to desiccation; after some day's exposure to a very hot sun, the hay collected on each slip was separately weighed with the greatest care. I present under the tabular form the results of these different experiments, calculated per hectare

* *Are*—A land measure, nearly equal to 2 poles.

† *Hectare*—100 ares.

tried according to their present price in Flanders, I have completed the table with ciphers facilitating the appreciation of this utility by other countries :—

Nos.	Nature of the manure employed.	Quantity per hectare.	Price per 100 kilogr. carried to the land.	Quantity of hay gathered with the addition of manure per hectare.	Supplementary quantity of hay due to the manure.	Price of hay per 100 kilogr.	Expense.	Receipts.	Difference expressing the profit by + and the loss by —
		kilog.	francs.			francs.	fr. c.	fr. c.	fr. c.
1	Hydrochlorate of ammonia....	266	100	4000	1716	8	266·00	137·28	— 128·72
2	Sulphate of ammonia	266	60	,,	1233	,,	159·60	98·64	— 60·96
3	Nitrate of soda.....	133	65	,,	800	,,	86·45	64·00	— 22·45
4	Nitrate of soda.....	266	65	,,	1723	,,	172·90	137·84	— 35·06
5	Ammoniacal liquor (*a*) of the gas works	litres. 5400	1	,,	2300	,,	54·00	184·00	+ 130·00
6	Gelatinous solution of the animal black manufactories (*b*)	21666	0·75	,,	2493	,,	162·49	199·44	+ 36·95
7	Urine of the horse	21666	0·75	,,	2240	,,	162·49	179·20	+ 16·71
8	Flemish manure (*c*).....	21666	0·75	,,	3433	,,	162·49	274·64	+ 112·15

of surface, and as the question comprehends the utility of the application of the products,

(*a*) The ammoniacal liquor of the gas works at Lille, which was used in this experiment, marked four degrees of the areometer; before being spread on the land, the ammonia contained in this liquid was converted into hydrochlorate by the mixture of the ammoniacal liquid with twice its bulk of acid water, arising from the acidification of bones in the manufacture of gelatine. This residue had not hitherto been turned to account in my works.

The phosphate of lime resulting from the decomposition remained mixed with the liquid spread on the land, but its immediate influence must be rather considerable, for an experiment made in the same circumstances, by decomposing the same quantity of acid solution of phosphate of lime, by means of a slight excess of lime, but without the addition of ammonia, gave no appreciable result. Without denying the influence of this phosphate as a manure or fertiliser, I am convinced that its action can be exerted only very slowly.

(*b*) Liquid obtained by ebullition in water, to which I submit the bones, in order to extract the fat from them. The gelatinous water which remains after the separation of the fat from the bones, contained $\frac{1}{2}$ per cent. of impure and somewhat altered gelatine.

(*c*) The Flemish manure employed consisted of urine and pure fecal matters. It was less aqueous than that commonly sold to the cultivator. The sale of this product being a servant's perquisite, the latter takes care to add to it all the house-slops; consequently very considerable differences are remarked in the fertilizing action of this manure.*

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* A few days after the manures were spread, their action on vegetation might be perceived: the manured slips of land were of a much deeper green.

In Nos. 1, 2, 3, and 4, they arrived at perfect maturity; in the following numbers, and especially Nos. 6 and 8, the grass was less ripe, but it was advisable to mow it, because it began to grow weak and straggling, and would soon have rotted.

The foregoing table permits the establishment of the following relations :—

	Nitrogen per 100 of manure.	Supplementary quantity of hay obtained from a first crop.	Quantity of hay per 100 of nitrogen employed.	Quantity of hay containing 100 of nitrogen according to M. Boussingault.
Muriate of ammonia	26·439	645	24·395	10·000
Sulphate of ammonia....	21·375	463	21·660	,,
Nitrate of soda	16·577	647	40·056	,,
Gelatine dried according to experiment 6.	16·980	414	24·355	,,

The experiments detailed in the two foregoing tables give rise to the following deductions :—

THEORETICAL POINT OF VIEW.

1. The ammoniacal salts directly employed as manures act like the ordinary nitrogenous manures ; the quantity of products gathered is in direct ratio with the quantity of nitrogen which the different salts contain.

2. Nitrate of soda employed as manure gives analogous results ; the nitrogen of the nitrate of soda seems even more easily assimilated than that of the ammoniacal salts, unless the soda of the nitrate be regarded as having assisted in the development of vegetation.*

3. The importance of the crop was, in my experiments, in direct ratio with the quantities of nitrate of soda employed.

4. The gelatinous solution employed as manure had an energy of action which, compared with that of the muriate of ammonia, is in proportion to the quantities of nitrogen which the two bodies contain.

5. Professor Liebig, in his Agricultural Chemistry, setting out with the supposition that 1 kilogramme of rain-water contains only $\frac{1}{4}$ of a decigramme of ammonia, proves that an acre of land (2,500 square metres) annually receives more than 40 kilogrammes of ammonia, and, consequently, 33 kil. 8 of pure nitrogen, a greater quantity than is necessary for forming 1,325 kilogr. of corn, 1,400 kilogr. of hay, and 10,000 kilogr. of beet-root.

It can only be concluded from this argument, that in all circumstances atmospheric air furnishes to plants the quantity of nitrogen necessary for their development.

My experiments demonstrate that if this quantity of nitrogen exists effectively in rain-water, in a state in which it is assimilable by plants, a supplementary quantity should be furnished by nitrogenous manures in order to cause vigorous vegetation.

They demonstrate also that this nitrogenous manure interferes not only in furnishing its nitrogen to the plant, but also in giving to the plant the assimilating force necessary for acquiring a greater quantity of nitrogen from the atmosphere.* They show that the assimilating force of plants increases with the quantity of nitrogen furnished to them, and this opinion I consider to apply not only to the assimilation of nitrogen, but also, and in the same degree, to the assimilation of the alkaline salts, of the phosphates, finally, of all the mineral substances which are indispensable to good vegetation, and especially to fructification.

There exists, therefore, a connection between the two agents which, taken separately, can give only incomplete results.

But there is another point of view in which it is advisable to regard the intervention of ammoniacal salts, and which, it appears to me, has not hitherto fixed the attention of chemists.

(To be concluded in our next.)

* An experiment made, in the same circumstances, with quantities of dry sulphate of soda equal to those of nitrate of soda, gave no result ; the vegetation was not more active than without the employment of this salt. But it is possible that the soda arising from the decomposition of nitrate of soda, and capable of forming organic salts of soda, may act differently from soda engaged in so stable a combination as sulphate of soda.

* For 100 parts of nitrogen furnished by the manure, and representing, according to an analysis of M. Boussingault, 11,000 kilogr. of hay, there was produced in my experiments 21, 24, and even 40,000 kilogr. of hay : there was therefore furnished to it by the atmosphere, doubtless in the state of ammonia, a more considerable quantity of nitrogen than that furnished by the manure.

ON SOME EXPERIMENTS RELATIVE TO THE EMPLOYMENT OF LIQUID MANURE AND AMMONIACAL SALTS, FOR FERTILISING VARIOUS CULTURES.*

BY M. SCHATTEUMANN.

I have limited my experiments of this year, 1st, to ascertaining the power of solutions of ammoniacal salts; 2nd, to finding the quantity of these solutions proper for fertilising various cultures.

These experiments, made during the months of April and May, 1843, produced very remarkable results.

I prepared solutions—1st of sulphate of ammonia; 2nd, of muriate of ammonia; 3rd, of phosphate of ammonia, of 1 and 2 degrees of strength, according to Baumè's areometer. These solutions, poured on meadows, and fields of wheat, barley and oats, in the ratio of 2, 4 and 6 litres (quarts) per square metre, produced in fifteen days, and even earlier, a vegetation so much the more active as the solution poured on was stronger or in greater quantity. After several experiments, I thought I might rest satisfied with the solution of 1 degree, and with the quantity of 2 litres per square metre, as being sufficient for fertilising fields and meadows, and for giving a vigorous vegetation of a deep green.

Sulphate and phosphate of ammonia produced nearly the same effect; but the action of muriate of ammonia appeared to me to be more powerful.

I employed simultaneously the waters of a cesspool at 1 degree, saturated with sulphate of iron or sulphuric acid, and I obtained from it effects analogous to those of solutions of other ammoniacal salts.

The waters of the dung trenches, saturated at 1 degree, produced little action, and it is necessary to employ them at 2 degrees of strength, because they contain less of ammoniacal salts and matters in solution, which prevent the exact indication, by the areometer, of the quantity of salts which they contain. I watered cabbages, spinach, salads and other pot-herbs, with solutions of other ammoniacal salts, and water of cesspools of 1 degree, and they throve perfectly, by adding them to the plants when in full vegetation, but these newly pricked plants, watered in the same manner, visibly decayed. I concluded from this that it is necessary to apply the solutions of ammoniacal salts to the plants when they are in full vegetation, especially as we should be liable to lose a great portion of them by rain and by the decomposition which might take place by the action of the earths or by other causes, if they were spread during the dead season. Besides the spring is a very favorable period for the employment of these liquid manures, because the fields and meadows are easily accessible, and because the labors of cultivation are terminated.

I have frequently repeated the employment of ammoniacal solutions, even in large doses, on luzerne and clover, without having been able to produce the least appreciable effect. This is a radical exception, but the only one which I have met with in my experiments.

The employment of solutions of ammoniacal salts on meadows gave advantageous products. I gathered, on the high and dry part of a meadow, of a light earth, composed of sand mixed with a little clay, watered on the 12th May with 2 litres (quarts) of sulphate of ammonia, of 1 degree, per square metre, 89 kilogrammes of hay per *are*, whilst at the side, the *are* gave only 51 kilogrammes. A small piece of turf of six square metres, in my garden, watered with 12 litres of saturated water of cesspools, gave 6 kilogrammes of hay, or 100 kilogrammes per *are*; a similar place, by the side of the other, not watered with the solution, produced only $2\frac{1}{2}$, or 41·6 kilogrammes per *are*. 40 *ares* of a high meadow, argilo-calcareous soil, watered on the 28th of last July, with 2 litres per square metre, with the water of dunghills, gave, at the end of August, 1810 kilogrammes of after-grass, that is to say 45 kilogrammes per *are*; the same meadow, not watered, gave only 22 kilogrammes per *are*. Two litres of a solution of ammoniacal salts of 1 degree, or water of dunghills of 2 degrees, per square metre, appear to me to be suitable doses for meadows, and I will apply them on the large scale next year. I think that it is best to use this solution on meadows as soon as the vegetation becomes active, although the use which I made of it in the beginning of May succeeded very well; but this year was very rainy, and, moreover, there is no reason why this manure should not be applied as soon as vegetation is developed.

The ammoniacal salts appear to exert on wheat a more perceptible influence than on grasses, for eight days after their employment, this plant acquires a very deep green tint, a certain sign of great vigor of vegetation. I should think that the proportion of 2 *litres* at 1 degree per square metre is too great, since it caused too vigorous a vegetation, which produced less grain and more straw than the parts not watered, for it is generally known that a field which has been

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* *Comptes Rendus*, November 13, 1843.

too much manured produces more straw and less wheat than one which has been properly manured.

My experiments on a field of wheat in good condition, in a soil of lias, composed of clay and calcareous substances, gave the following results:—

	of wheat. kil.	of straw. kil.	Total kil.
One *are* watered with two *litres* of muriate of ammonia, of one degree, per square metre gave.....	28·1	79·4	107·5
Four *ares* watered with four and six *litres* of a solution of the same salt, of one degree, and with two and four litres of two degrees, per square metre, gave on the average, per *are*	21·7	78·3	100
One *are* watered with two litres of phosphate of ammonia, of one degree, per square metre, gave	27·4	77·6	105
Four *ares* watered with two litres of phosphate of ammonia of one degree, and two and four litres of two degrees, per square metre, gave, on the average, per *are*.....	24·4	83·1	07·5
One *are*, watered with two litres of sulphate of ammonia, of one degree, per square metre, gave.....	29·0	76·0	105
Four *ares*, watered with four and six litres of sulphate of ammonia of one degree, and two and four litres of two degrees, per square metre, gave, on the average, per *are*	22·3	80·2	102·5
One *are*, not manured, gave.....	29.2	70·8	100

The vegetation of the parts watered with too strong solutions, or with too great a quantity, was so powerful that the wheat laid down before pushing forth stems.

These result indicate that wheat watered with solutions of ammoniacal salts of two degrees, or of one degree in too large quantity, furnished the smallest product in grain and straw, and that the parts watered with only two litres of one degree also gave too strong a vegetation, which, in fact, produced more straw, but less grain, than the unwatered part of the same field. It must naturally be concluded from this, that a smaller portion of ammoniacal salts would furnish more advantageous products. I will continue my experiments on a larger scale next year, and I shall not fear to apply one *litre* of solution of ammoniacal salts to my fields of wheat, and even one and a half to two *litres* to poor lands, especially in a dry year, for the frequent rains of this year have given extraordinary force to vegetation.

The vegetation of barley and oats, planted in a good soil, which I watered with ammoniacal salts, was so active, that, not being able to hope that they would arrive at maturity, I cut them while green; but the action exerted on them by ammoniacal salts is certain.

Two *kilogrammes* of crystallized sulphate and muriate of ammonia are sufficient for saturating 100 *litres* of water; the hectolitre would therefore cost 1 franc and 20 centimes, at the commercial price of 60 centimes the killogramme of these salts. By employing two litres of this solution per square metre, it would require 200 hectolitres to fertilise one *hectare* of land, which would cost 240 francs. It would be only half, namely 120 francs, for a *hectare* of wheat, if, as is probable, one litre per square metre is sufficient.

The ammoniacal salts being very soluble, they may be dissolved, without heat, on the spot where they are to be used, if there be water at hand.

Urine, the waters of dunghills, and gas-liquor, saturated with sulphuric acid, or with sulphate of iron, or with hydrochloric acid, furnish very cheap ammonical liquors, which may be used with much advantage, and, at present, they are in a great measure wasted.*

* In saturating the ammonia of the dung trenches or cesspools, after having allowed them to ferment for two months, with sulphate of iron or an acid, it is important that the alkaline principle remain predominant, in order not to damage the plants. It is easy to ascertain the saturation by means of test paper. In order to

The liquid manure presents the advantage of enabling us to regulate its strength and employment as to proper quantity and proper time for fertilising the culture of a single year. We are thus able to distribute it equally, and are not exposed to the losses which result from the employment of manure for several years, according to their present practice.

400 kilogrammes of sulphate or muriate of ammonia are sufficient for manuring 1 *hectare* of meadow land. These salts may be conveyed to the most distant places where dung is deficient, without sensibly increasing the expense.

The manures considerably augmenting the crops, it is always useful to buy them when they can be procured at a price inferior to the value of the extra products which they procure. There is reason to hope that the ammoniacal salts will be able, to a great extent, to supply the insufficiency of manures, and to increase the products of agriculture.

I have sent to M. Boussingault samples of hay and wheat manured with ammoniacal salts, as he wishes to analyse them. This work will be of great utility, and will throw new light upon a subject so highly interesting to agriculture.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

MEETING OF THE PHARMACEUTICAL SOCIETY.

At the meeting of the Pharmaceutical Society, held at No. 17, Bloomsbury-square, on Wednesday evening, January 10, a paper was read, whose object appeared to be the defence of the chemist and druggist against certain attacks which have emanated from the pen of Mr. Phillips, and which have been published in the *Pharmaceutical Journal.*

After the paper had been read, it was announced by Mr. Payne, the chairman of the meeting, that the council would feel it necessary to suppress certain portions of the communication, previous to its insertion in the journal of the society. Having been present when the paper was read, and feeling that the value of the communication would be lost to those whom it professed to defend, if the editor, under the cloak of the council of the society, should divest it of its point and spirit, we have been at some pains to obtain a copy of the same, which we herewith submit to our readers, amongst whom number many who have been the objects of Mr. Phillips's rancorous attacks; and we leave them to form a just estimate of the compact between that gentleman and the Pharmaceutical Society, when the latter body dares not publish in its transactions, although it was published by the mouth of the reader to the society, a justly deserved criticism, perfectly fair, and in the most gentlemanly tone, for the simple reason, we opine, that it contains an apology for the members, and challenges the accuracy of an individual contributor.

The next article is the one to which we allude.

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recognise the excess of sulphate of iron, it is sufficient to take one drop of the saturated liquor, and to add to it a small quantity of a weak solution of prussiate of potash; this excess is immediately rendered evident by the formation of Prussian blue.

A watering tube of 1m. 66 in length, and and 0m. 08 in diameter, of zinc plate perforated with holes of 0m. 002, with spaces of 0m. 02, spreads very equally 2 litres per square metre, when the barrel is drawn by a horse. In employing less than 2 litres per square metre, it is convenient to dilute the liquid manure with water, this quantity being necessary for spreading it uniformly. When the waters of dung trenches or cess-pools are too thick to pass through the watering-pipe, they are filtered by a tub, in which is put 40 centimetres of straw between two false bottoms.

ILLUSTRATIONS OF OUR PHARMACOPŒIA.

BY G. M. MOWBRAY, FELLOW OF THE MEDICO-BOTANICAL SOCIETY, ETC.

The pharmaceutical chemist who conscientiously desires to obey the authors of the Pharmacopœia, and yet to preserve a uniformity of composition in his preparations, has no easy task before him. The directions are concise, and seem simple enough, but in reality they are not so:

> "Fronte exile negotium
> Et dignum pueris putes;
> Aggressus labor arduus,
> Nec tractabile pondus est!"

The vagueness of some of the directions might almost make one suspect that the chemical reviser of the last London Pharmacopœia did not always fully understand the formulæ which he sanctioned!

Before adducing examples of the uncertainty and vagueness which I reprehend, I will remind the reader that the necessity for accuracy has since been insisted upon by the College translator, in his "Illustrations of Pharmacy," published in the *Pharmaceutical Journal;* and it is, therefore, the more essential that the directions of the Pharmacopœia should be corrected when wrong, and cleared up when obscure. We must consider, too, that little people are often blamed for the mistakes of their betters:

"Quicquid delirant reges, plectuntur Achivi."

The chemical critic hastily supposes, that if preparations of the same name, obtained from different shops, should differ in composition, the druggist must necessarily be in fault; whereas it sometimes happens that the blame should be fixed higher up: the streams are not pure, because the fountain is turbid; in other words, the practical chemist may be censured, when the fault is in the formula which he is enjoined to follow.

Without farther preface, I will now state a few objections to some of the formulæ for the preparations of iron:

The second paper was entitled—"Illustrations of our Pharmacopœia," by G. M. Mowbray, Fellow of the Royal Medico-Botanical Society, &c.

I. FERRI SESQUIOXIDUM.

We are informed that the powder prepared by the College formula sometimes contains a small quantity of carbonic acid. This is really the case, and the formula is, therefore, inadmissible. as will be seen in treating of the *tinctura ferri sesquichloridi.* Moreover, the method is never followed by the manufacturing chemist, unless he wishes to make the *ferri carbonas saccharatum* of the Edinburgh Pharmacopœia.

When it is desirable to avoid the expense of procuring the hydrated sesquioxide, I would suggest a formula introduced, I believe, by Faraday, which formula yields a very beautiful per or sesquioxide, and has been since recommended by Berzelius.

Take of sulphate of iron, one part; chloride of sodium, three parts: mix intimately, calcine at a red heat, and dissolve out the saline mass. The sesquioxide remains as an impalpable powder, of a deep chocolate-red color. The objection to the London process is, that the product varies in composition. Sometimes, especially if not very carefully and rapidly prepared, it contains carbonate of protoxide of iron; but if more time be occupied in drying it at a low temperature, we then have a carbonate of peroxide with an excess of base.

When the former of these varying compounds is used to prepare the tincture of sesquichloride of iron, a mixture of protochloride and sesquichloride of iron is first obtained. By exposure to the atmosphere, the protochloride is converted into per- or sesquichloride of iron, whilst basic oxichloride or a subsesquichloride of iron is precipitated.

In Mr. Phillips's translation of the London Pharmacopœia, the following passage occurs:—

"This tincture is of a reddish-brown color, and though it is *essentially composed of sesquichloride of iron,* it contains some hydrochloric acid, without which deposit is apt to be formed in it."

Now, if Mr. Phillips had prepared a *tinctura ferri sesquichloridi* either with a pure sesquichloride, or even with the moist hydrated sesquioxide of iron, he would have doubted the propriety of giving the formula for *ferri sesquioxidum* which now stains the pages of the *London Pharmacopœia;* for he must have observed, that if either of these be used, it is not necessary to have free hydrochloric acid in order to prevent a deposit. Lamenting such decomposition, why not remedy it? It was merely requisite to direct the tincture to be made with the dry perchloride procured by sublimation—a method which I strongly recommend; and I have devised a formula, wherein the play of affinities is somewhat complex, yet interesting; whilst the process is sufficiently facile to be accomplished without much skill on the part of the operator. Take of iron filings, ℥ij.; hydrochloric acid (sp. gr. 1·160), by troy weight, ℥v. ʒvij.: digest in a Florence flask, assisting the complete saturation of the acid at the end of the process by a gentle heat.* When all action has ceased, filter the liquid, and evaporate to four fluid ounces. Next weigh out pure sulphate of iron (crystals powdered), 250 grs.; hydrochloric acid (sp. gr. 1·16), by troy weight, ℥iij. ʒij.; powdered chlorate of potassa, 246 grs.: dissolve the sulphate of iron in the muriatic acid; mix the two solutions; then add the

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* A bent tube should issue from the mouth of the flask, and be made to dip under a small quantity of water, to prevent loss of acid. This acidified water is then returned on the filings with a view to obtain the full effect of the acid.

chlorate of potassa: from the blood-red solution thus obtained, precipitate the (two equivalents) sulphate of potassa by the addition of sixteen fluid ounces of rectified spirit of wine: filter, and wash the precipitated sulphate of potassa with sufficient spirit to make up twenty-six fluid ounces of tincture. One fluid ounce contains 64·4 grains of sesquichloride of iron, equivalent to thirty grains of sesquioxide, or 20·8 grains of metallic iron.

II. FERRI POTASSIO-TARTRAS.

The formula for this preparation is vague and inaccurate. It is as follows:—Take of sesquioxide of iron, three ounces; hydrochloric acid, half a pint; solution of potassa, four pints and a half; or as much as may be sufficient; bitartrate of potassa, eleven ounces and a half; solution of sesqui-carbonate of ammonia, a pint; *or as much as may be sufficient;* distilled water, three gallons. The first directions are intended to procure the hydrated sesquioxide of iron, which is to be dissolved in a solution of bitartrate of potassa. Then follows this passage:—

"If the liquor should be acid, when tried by litmus, drop into it the solution of sesquicarbonate of ammonia, until it is saturated."

The translator observes, in his remarks, that he "found it to consist of very nearly one equivalent of tartrate of potassa, and one equivalent of tartrate of sesquioxide of iron." "This," he continues, "would give rather more than 18 per cent. of sesquioxide, which agrees very nearly with my direct experiment."

FIRST PROCESS.

18 eq. Hydrochloric acid { 18 eq. Hydrogen—18 eq. Hydrogen gas.
18 eq. Iron { 18 eq. Chlorine, 18 eq. Iron } 18 eq. Protochloride of iron.

SECOND PROCESS.

18 eq. Protochloride of iron { 18 eq. Chlorine; 18 eq. Iron
18 eq. Hydrochloric acid { 10 eq. Chlorine; 10 eq. Hydrogen, 10 eq. Oxygen } 10 eq. water
2 eq. Chlorate of potassa { 2 eq. Chlorine; 2 eq. Potassa } 2 eq. sulphate of potassa.
2 Sulphate of iron { 2 eq. Sulphuric acid; 2 eq. Iron
} 20 eq. Sesquichloride of iron.

All this "very nearly," and "about," is unworthy of Mr. Phillips. Either he has permitted one of his pupils to mislead him in this preparation, or he has misunderstood the language of Soubeiran, from whom the formula is said to have been taken, with alterations.

In the London Pharmacopœia, we are told to boil the sesquioxide of iron in the solution of bitartrate of potassa, while Soubeiran insists upon digestion; for he observes, "prolonged ebullition of the salt in water, above all in the presence of an excess of cream of tartar, causes decomposition and deposit of tartrate of protoxide of iron." I have myself suffered by attending to the directions of the Pharmacopœia; for on one occasion I found the iron reduced from the state of peroxide to that of the green magnetic oxide, whilst operating in a stone vessel containing about eighteen gallons of the solution. The phrase, "*if* the solution be acid to litmus paper," sounds not a little strange to our ears. I would ask Mr. Phillips, "Can a persalt of iron be other than acid to litmus paper?" And in order that those who peruse this paper may form their own judgment on these alterations, I subjoin a translation of Soubeiran's formula.

"Take of powdered cream of tartar, one part; distilled water, six parts; moist hydrated peroxide of iron, q. s. Digest the whole in a porcelain or glass vessel, at a temperature varying from 120° to 140° F., until the liquid refuse to dissolve more of the hydrate: filter, and evaporate at a gentle heat; when the liquid becomes somewhat concentrated, spread on plates, and dry in the drying-room." What improvements can be required in this process? It is simple and concise, and affords a uniform product. The author has evidently considered his subject thoroughly, and practised what he orders. His experiments have been direct; not so those of Mr. Phillips, who, although he has ordered four ounces of sesquicarbonate of potassa, "*if* the solution be acid to litmus paper," yet in his analysis he cannot detect the least trace of the alkali? What is stranger still, he arrives at figures

giving 5 per cent. more sesquioxide of iron than Soubeiran, although our French fellow-laborer makes no mention whatever of ammonia! Is it to be wondered at, then, that the chemist should be perplexed, the physician annoyed, and sometimes even the patient alarmed, when the ferri potassio-tartras may sometimes contain ammonia, and at other times none—when the tinctura ferri sesquichloridi may contain an excess of acid to-day, and become *sua sponte* duly neutralized to-morrow?—when the sesquioxide of iron may contain carbonate of protoxide of iron in Bond Street, and basic carbonate of peroxide in Piccadilly? I hope that the frankness of my tone will not give offence; my object being not to diminish the well-earned reputation of a distinguished chemist, but to improve the practice of pharmaceutical chemistry.

ON INDIGENOUS OPIUM,*

EXTRACT FROM A REPORT OF MM. DE MIRBEL, BOUSSINGAULT AND PAYEN, AND PROCESS OF TESTING FOUNDED ON THE COMPARATIVE DETERMINATION OF THE PROPORTIONS OF MORPHIA.

I WILL here sum up in a few words the history of the culture of indigenous opium, which, I think, will be interesting to the reader.

Dubuc, of Rouen, was occupied in the year IX. with the culture of the Papaver somniferum, and with the preparation of opium in *extract* and in *tears*.—(*Ann. de Chimie*, t. 38, p. 181.)

M. Lorseleur Deslonchamps made numerous experiments with the view of substituting indigenous opium, under these two forms, for the exotic products. On this occasion he received a testimonial of satisfaction from the class of the Institute.—(*Moniteur* of 1811, p. 775).

The late Mr. Hennell obtained from 700 grammes of opium, cultivated in England, by Messrs. Cowloy and Stairs, 48 grammes of morphiæ. (Botany of Drugs: Thompson, p. 202).

In 1817, The Society of Encouragement of London, awarded a gold medal to Mr. John Young for his method of cultivating the papaver somniferum, and of collecting the opium from the capsule without diminishing the crop of seeds; but in recommending the combined culture of poppies and potatoes, the author announced exaggerated profits of 2,400 *francs per hectare*, which neither he nor others realised.

In the following year, Vanguelier demonstrated the presence of morphiæ in indigenous poppies; afterwards MM. Peschier, of Geneva, and Duprat, of Toulouse, also obtained this proximate principle from the capsules of the *papaver somniferum*; and M. Tilloy, of Dijon, extracted it in the large way, from the dried capsules deprived of their seeds.

In 1826, M. Petit, of Corbeil, employed the stems, leaves and capsules of the plant for preparing aqueous and alcoholic extracts which appeared to him to contain the same principles as exotic opium, the proportions being excepted; he announced that the opium obtained by incision of the capsules of poppies cultivated near Dijon had furnished from 16 to 18 per cent. of morphia,* a result which will appear incorrect, when compared with the proportions obtained by the most skilful chemists.

Such were the conclusions of investigations made with great care by M. Dublanc, and communicated to the Academy of Medicine on the 15th of July, 1826, and 27th of March, 1827, at first on opium obtained by incision of the capules, by M. Caffin, of Orsigney, agriculturist of Leiuvet-Oise: this sample gave 2 per cent. of morphia, whilst the mean of his analysis of opium from the East furnished 8 per cent.; another sample of opium obtained by incision of the capsules of the poppies cultivated in the environs of Toulouse, gave 4 per cent. of morphia. M. Dublanc was, moreover, occupied in this series of investigations, with the comparative determination of the various proximate principles contained in opium prepared by aqueous or alcoholic infusion and by decoction of the capsules of the artric plants; he quoted, in support of his results, the investigations relative to the extraction of morphia from indigenous poppies undertaken by Vogel, Blondeau, Chevallier, Delafolie, and Geiger.

The conclusions of the work of Pelletier were much more encouraging, especially if we compare the analytical results with the idea expressed by the author, that the *papaver somniferum* grows with facility in France, even on bad soils; but he should have informed us whether in this case the opium collected was as abundant and of as good quality, which is not very probable.

These experiments were undertaken with the view of determining the quality of the

* *Journal de Chemie Médicale*, Jan. 1844.

* M. Cavarton announced, in 1827, that 36 parts of indigenous opium contained 8 parts of morphia, or 22 per cent. (*Journal General de Medecinæ*, 2e, Série t. VI., p. 72).

opium which General Lamarque had obtained by incision of poppies cultivated on his lands; in Pelletier's Memoir (*Journal de Pharmacie*, Vol. XXI. p. 572,) we read:—

"500 grammes of French opium will give 51 grammes of morphia," corresponding to 10·2 per cent.

Further on, Pelletier adds:—"500 grammes of opium from the East will give only 45 grammes of morphia," or 9 per cent.

It is evident that the comparative analysis of the opium of Smyrna and that of the environs of Bordeaux showed a difference in favor of the latter, analogous to that which we now find between the product collected in Algiers and the opium of the East.

With regard to the enormous proportions of 14 and 22 per cent. of morphia obtained by M. Caventou from samples of indigenous opium, they can be explained only by the impurity of the product.

The proportion of morphia indicated by Pelletier, more considerable than that obtained by the other experimenters, does not, however, amount to more than 10·2 per cent. of morphia for indigenous opium: we are not warranted in repressing a doubt relative to the proportion of 12 per cent. announced in a sample brought from Algiers.

Be it as it may, we do not think it right to raise, beyond the terms of our report, the hopes which we have expressed concerning our future collection of opium in Algiers.

The enlightened solicitude of the Duke of Dalmatia for the interests of our colony of Algiers, will doubtless induce him to continue his experiments on the culture of the *papaver somniferum*, and on the extraction of opium. We will examine the samples which may hereafter be sent to us; but in order that their quality may be ascertained on the spot, we think it right here to indicate one of the processes most easily followed, for determining, comparatively at least, the proportions of pure morphia in various indigenous and exotic samples.

COMPARATIVE ANALYSES OF SAMPLES OF CRUDE OPIUM.

25 grammes of opium cut in very thin slices, and left to macerate in 150 grammes of pure water. After 24 hours' contact, it is triturated in a mortar until the hydrated matter is clear; then the most finely divided parts which the liquid holds in suspension are decanted on a filter; water is added to the residue, which is triturated *de novo* and decanted on the same filter which is again washed with distilled water until the liquor passes through colorless; an excess of well-slaked lime is added to the filtered solution;* the mixture is boiled for about five minutes, filtered, and the filtered solution is acidulated with hydrochloric acid, which saturates the lime and combines with the morphia. The morphia is precipitated by ammonia, the excess of which is driven off by boiling. The morphia is collected on a filter, and washed with alcoholised water, then dissolved in alcohol of 33 degrees; it crystallises by cooling; it is then sufficient to wash it with ether, to eliminate the narcotine; it is afterwards dried and weighed.

There certainly remains a small quantity of morphia in the liquid from which it has been precipitated; it might be obtained by a second treatment after evaporation, but the operation would then become long and rather more difficult; besides this is not necessary for determining which of several samples contains most pure morphia; the most simple assay gives even more sensible differences, because the least rich opium is that which leaves in the solution a larger proportion of morphia relative to the quantity which it contains.

It would be desirable for all pharmaciens to take the trouble of testing the medicinal opium which they buy; they could then present to practitioners medicines less variable in their effects, and they would assist in the destruction of frauds, which would cease to be profitable to their authors, and which are sometimes so prejudicial to the interests of medicine.

ON MUSK.†

This substance is found secreted in a bag attached to the male musk deer, whose habitat is the mountainous Kirgesian and Sangorian steppes of the Altai, on the river Irtysch. It exists also in Mongolia, Thibet, and Butan or Bontain, as far as Tonquin, and generally on the mountains of Eastern Asia, ranging between 30° and 60° of latitude.

In trade, two distinct species of musk are known, comprising the Chinese Tonquin, Tiberiae or Oriental musk, and that which includes the Siberian, Cabardinian, or Russian musk. These varieties, the one Russian and the other Chinese, differ materially both in external appearance of the bag and

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* One of the best means of completely slaking and thoroughly dividing lime, consists in pouring on 1 part of quick lime two parts of boiling distilled water; in a few minutes the extinction will be complete, even when a small quantity is acted on.

† *Annals of Chemistry.*

the color of the hair which covers it, as well as in their chemical and physical properties, and different effects on the human constitution.

These differences exist chiefly on account of the difference in climate which the animals inhabit, and the food which such variations in temperature occasion. Dr. Goebel is of opinion that these different properties of Chinese musk, as compared with the Russian, should be attributed to the difference of treatment which they undergo in China, and he considers that the Chinese musk is the natural product after it has been subjected to the ingenious adulterations of the Chinese. The following are the reasons for this supposition :—

Irbit, a small town of Asiatic Russia, known chiefly for the considerable barter trade which is there carried on in the month of February between Russian, Bucharian, and Chiwinzian tribes, with Persian, Armenian, and other Asiatic nations, is the main market for Siberian musk. It is less frequently taken to the market of Nischnei Novgorod. The Asiatics bring to Irbit the musk bags enveloped in the original greyish-white skin, as cut from the musk deer, and sell them, either to the Russians, who carry them to St. Petersburg and Moscow, or they dispose of them to Russian traders, who carry on a commerce with China by Kjachta.

The Russian merchants, who bring the musk from Irbit to St. Petersburg and Moscow, trade only between these towns and Irbit, but those who carry it to Kjachta trade only between the said town of Kjachta and Irbit.

In case the price of musk is remunerating at St. Petersburg and Moscow, then the Russians who trade there purchase the musk bags, and pay good prices; on the other hand, when it is low in these places, the Asiatic finds his customer in the trader to Kjachta. Sometimes it is brought to St. Petersburg in large and sometimes in small parcels, occasionally packed in chests, whilst at others it is loosely carried in bags of leather or felt, and sold generally to druggists.

The price of musk at St. Petersburg is regulated by the quantity of stock in hand. The Russian trader procures European wares with the produce of his sale, which wares are destined to procure at Irbit a further supply of the drug. At St. Petersburg it is packed in tin caddies, hermetically soldered, and when exported, these are packed in small wooden cases.

The Irbit musk is invariably enveloped in the greyish-white belly skin, and the bags are separated when it is sent to St. Petersburg, this being done only after it has been sold to the St. Petersburg trader; for a bag accompanied with the skin rarely arrives at St. Petersburg. If, however, the musk is sold to those traders who proceed with their wares for the Chinese market *via* Kjachta, this appendage is indispensable, because the Chinese, who exchange tea for it, would not purchase it except in its original state. From Kjachta it is taken into the interior of China, and the process of adulteration it there undergoes is entirely unknown; but it is a fact, the authenticity of which is indisputable, that no Russian musk bag is ever re-imported from China *via* Kjachta, the only trading mart between Russia and China; and further, that not a single bag of Chinese musk ever arrives in Russia *via* Kjachta.

In one year 300, 400, and even upwards of 500 pounds of Russian musk have been carried to China by Kjachta. In such years it may be presumed that but little musk arrived at St. Petersburg, where the rise and fall of the market price is governed by the quantity imported.

From St. Petersburg and Moscow there is annually exported a quantity of Russian musk, amounting on an average to 500 pounds. Perhaps one half of this quantity is destined for the London market, where, more especially, the smallest bags are in demand, whilst the remainder is distributed amongst other European markets, more especially those of Holland and Germany, where the greater part is consumed.

The Russian musk, when exported from Russia, is always genuine and unadulterated; the bags never being opened, are consequently never sewn, or closed in any artificial manner. Sometimes it is obtained so fresh that moisture may be expressed therefrom by cutting through the fleshy side of the bag. The interior mass is frequently of a soft and pappy consistence; externally, however, the bags are perfectly dry.

Dyrssen, an eminent Russian merchant, proved to Dr. Goebel, by his books, that he annually exported, on an average, about 200 pounds of Russian musk, and he stated, that through other houses at least a similar aggregate quantity was sold; and, lastly, from Moscow, in the winter, there was sent, *via* Brody, to Vienna, and through other channels, at least 100 pounds, giving an annual total of 500 pounds of Russian musk, which was rather below than above the average quantity exported.

That what is termed Tonquin or Chinese musk comes into the market only through the London trade, and by no other channel; although much of this is consumed in Russia, no bag being ever received *via* Kjachta, but always imported directly from London. These Chinese musk-bags are found, on examination, invariably to have

been opened, and more or less carefully glued together; sometimes, indeed, the stitches are visible by which they are held together.

We have the assurance of Dyrssen, that during the many years he has been engaged in trade, although he has frequently received quantities of from 100 to 200 ounces at a time from London, yet in no case whatever has he met with a bag which had not been opened, and closed with more or less ingenuity. He believes, also, that he has recognised the Siberian bags, although somewhat modified. Whether the Chinese musk, in its peculiar package, is received in that state at the English factory at Canton, as is most probably the case, or whether it is there made up, we are not in a position to state. Dr. Fr. Goebel relates, that in the year 1825 he received, through Jobst and Klein, of Stuttgard, a musk-bag, to which was adherent a portion of the skin attached to the belly: this Dr. Goebel opened, in the presence of the eminent naturalist, Oken, and it was represented by Ratzeburg and Brandt, in their description of officinal animals; and of which Oken gave an account in his "Isis," and which appeared also in Kastner's "Archives." This bag, which the Doctor has still in his possession, was of the same form, and in color and size of the hairs, precisely similarly to the Russian musk-bag, with which he had an opportunity of comparing it whilst on a visit to Russia. The contents, however, of this musk bag differed materially, in their chemical and physical proprieties, from those of the pure Siberian musk bag. Buehner, in his "Repertory," has given a description of a musk bag, which coincides with that in Dr. Goebel's possession. The weight of grain musk from this bag was 225 grains, and cost thirty Thaler conv. munze—about 4*l*. 10s.

If we take a Chinese musk bag, with its partially bald surface and yellowish-brown hairs here and there cut off, and soften the same by digestion in warm water, we perceive pretty plainly that it has been subjected to artificial changes. The external skin is tender, and may be easily torn, as if it had been destroyed by partial decomposition; the hairs have either fallen off or been removed by force: indeed, the longer hairs clearly appear to have been cut off.

Why do not the musk bags from China arrive as perfect as those from Russia? Because the contents have been removed and the bags refilled, as may be distinctly perceived by those hairs which surround the interior small opening which is found on the hairy side of the bag, immediately before the genital canal, being depressed; whilst in the Russian musk bags these small hairs are found standing obliquely, and protruding in and between the secretion. It is possible, although not at all probable, that the musk deer, which abound in Thibet, Butan, &c., may possess musk bags of a perfectly distinct character from the Russian, but no trustworthy reference or practical judge has ever witnessed the removal of such a bag from the living animal, or described it and its contents. That the grain musk of the Chinese musk bags which have been brought to Europe, differs very much in its effects, as well as in its physical and chemical characters, from the pure Siberian, has been ascertained; and that it likewise acts with more energy on the living economy when administered internally. All the different chemical investigations of musk, for which we are indebted to Buchner, Wetzlar, Oberdoeffer, Thiemann, Blondeau and Guibourt, Geiger and Reiman, &c., taken together, afford very few hints in reply to those questions, which involuntarily present themselves, in reference to the two different kinds of musk, so far as regards their chemical and mercantile relations.

Taking, therefore, the most essential points of the preceding communication—

I. That the Russian musk is always sold in perfect bags, and exported in considerable quantities to China and to London.

II. That from China to Russia no direct exportation of musk takes place.

III. That the Chinese musk can only be obtained *viâ* London.

IV. That the Chinese musk bags never arrive unopened.

V. That it appears most undoubtedly that the mass has been taken out and replaced.

VI. That the external appearance of the bags proves sufficiently that they have undergone artificial treatment.

VII. That frequently the secretion apart from the bag is imported from China, leading to the inference that a sufficient number of bags cannot be obtained wherein to put the quantity increased by adulteration.

Taking all these reasons into consideration, we think the conclusion announced at the commencement cannot be avoided, viz., that the distinctly marked difference of the Chinese from the Russian musk, if not wholly, it is at any rate chiefly, caused by the treatment which it undergoes in China; and therefore that Chinese musk is the natural product after it has been modified by artificial means.

It is a fact worthy of remark, as showing the ignorance which exists in reference to the places whence products are obtained, that notwithstanding the facts that London receives the greater quantity of Russian musk, yet that, in the Trades' List and Prices Cur-

rent, no mention is ever made of Siberian or Cabardinian musk.

In reference to the quantity of musk on which duty has been paid, we find, on referring to the Customs' official documents, that, in the year 1842, up to June 28th inclusive, the duty of sixpence per ounce was paid on sixteen hundred and forty-three ounces, whilst, during the same term in 1841, only five hundred and one ounces were cleared.

At the port of London alone, from June 1841 to June 1842, duty was paid on nine hundred and sixty-nine ounces.

PREPARATION OF MERCURIAL OINTMENT.*

BY M. FOSSEMBAS.

Few pharmaceutical preparations have given rise to so many investigations and theories as mercurial ointment; so much has been said on this subject, that the following may at first sight appear fastidious and useless.

I admit that it is not without a certain feeling of diffidence that I publish these observations, which have led me to the employment of a process by which I am able to prepare, in less than an hour, eight pounds of mercurial ointment.

The process which I have followed has nothing new in it, since it consists merely in the use of *rancid grease;* but it is of such easy and rapid execution, that I have considered it my duty to rescue it from the oblivion into which it has fallen.

Only twenty-five grammes of this substance are required to the livre of ointment, and so small a quantity of product is not capable of giving injurious properties to a medicament, which *cannot long be preserved from rancidity*, and which is *seldom or never employed except in this state.*

The conditions of a prompt division of the metals are reduced to two:—1st. *To dividing by trituration.* 2nd. *To preventing the reunion of the separated parts.*

The first condition is always fulfilled; but the second seldom, if ever. Indeed, recent lard being deficient in agglutinative properties, cannot, therefore, retain the mercurial powder, and prevent the reunion of its particles.

Fresh lard is, therefore, incapable of completely "killing" mercury.

Will it be objected to me, that vigorously continued labor is always, in a little time, followed with success? To this I reply, that I have never seen the labor terminated before the grease had determined an evident odor of rancidity.

But why is this state of alteration favorable to the extinction of the metal? The examination of this very matter will serve for a reply.

That which at once attracts our notice in rancid grease, is its consistence. If it be left only until that degree of alteration at which it still possesses a certain softness, it is immediately perceived that it has acquired very evident agglutinative properties. If it be agitated in the mortar, it adheres very firmly to the pestle, and makes a noise similar to that made by beating turpentine.

If, into the midst of this matter thus triturated, a certain quantity of mercury be poured, the agitation being continued, the metal will be immediately divided, and the *adhesion* of the grease, which will *envelope* each of its *particles*, will necessarily *prevent* their reunion. When we reflect on the profound and extensive division which each stroke of the pestle operates on a body so fluid as mercury, we shall not be surprised at the possibility of causing, in a few minutes, large quantities of metal to disappear in a small proportion of rancid grease.

This being enunciated, I arrive at the facts which prove it; and I will content myself with purely and simply relating them.

I for some months exposed to the contact of humid air about a pound of that fat, of little consistence, sold by the pork butchers. When I employed it, it was not hard, but it adhered tenaciously to the fingers. I took 200 grammes of it, and I triturated it for a few minutes in a marble mortar; it became as soft and as thick as honey. I poured into it four pounds of mercury, by portions of 300 grammes at a time, and five minutes sufficed for the complete extinction of the metal; only, after having introduced the fourth portion, the ointment had acquired hardness; but the operation could easily be continued by the addition of a little oil of sweet almonds.

By operating as I have just said, I was able to incorporate four pounds of mercury in the 200 grammes of fatty substance employed. The microscope detected not the smallest metallic particle in the whole mass. Arrived at this point, I added the 1,800 grammes of fresh lard, half melted, and, after a quarter of an hour's agitation, I had a perfectly homogeneous ointment, in which the mercury was irreproachably extinguished.

[The process described by M. Fossembas is not very new, as he himself acknowledges; but it succeeds very well. It is

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* *Journal de Pharmacie*, January, 1844.

analogous to the method of MM. Coldefy and Simonin, which consists, as is known, in extinguishing mercury by means of a small quantity of lard, which has been prepared by melting it, pouring it into water, and exposing it to the action of the air.—Eds. Journ. de Pharm.]

TESTING FOR ARSENIC.

To the Editors of The Chemist.

Gentlemen,—

In the paper of mine, which you have honored me by extracting from *The Lancet*, you have inadvertently overlooked a correction which I sent, after the publication of that paper, to *The Lancet*, relative to the diagram. The formula for arseniuretted hydrogen is there incorrectly represented as As H, instead of As H^3, which of course leaves 2H unaccounted for. I gave the corrected diagram in a second paper in the above publication, to which I beg to refer your readers.

You will oblige me by either inserting this note, or inserting an erratum to the same effect.

I remain,
Gentlemen,
Obediently yours,
Robert Ellis.

University College,
Jan. 19th, 1844.

ASTHMA CURED BY THE INHALATION OF THE GASES OF THE PURIFYING HOUSE OF THE GAS WORKS.

To the Editors of The Chemist.

Gentlemen,—

Having been a subscriber to your excellent journal from its commencement, and having observed with great pleasure your evident desire to publish in it whatever, either in Chemistry or Pharmacy, has the object of preventing or alleviating the "ills that flesh is heir to," I will, if you please, trouble you with the following facts, which may lead some of your medical readers to a remedy for a disease under which thousands are at this moment sighing, and, perhaps, dying.

A man was employed at the West Bromwich Gas Works, about five years ago, who was very much afflicted with asthma, which he had had upon him for many years; he was put to work in the purifying-house, and although at first he did not think it agreed with him, at the end of six months he scarcely felt any symptoms of his complaint. However, about that time, he took to drinking, and was discharged. In about two months his wife came to beg that he might again be restored to his situation, observing that it was the only thing that would save his life, as since he had left it his coughing and hard breathing had returned as bad as ever. He was again taken on, and continued about three years in his situation, during which time his disease completely left him; since then he has worked at various kinds of outdoor employment, and has had no return, and he believes himself to be quite cured.

You are doubtless aware that the men in purifying coal gas inhale a considerable quantity of carburetted hydrogen, sulphuretted hydrogen, and ammoniacal gases; and it is to one or more of these gases that the effects above described are to be attributed. It appears to me perfectly reasonable that, whatever be the medicament employed, there is no better way of applying it to the lungs than in the form of gas.

I am,
Gentlemen,
Your obedient servant,
J. E. Clift.

Pagoda Gas Works, Birmingham,
Jan. 10th, 1844.

MEANS OF OBTAINING IODIDE OF IRON.*

BY M. MIALHE.

Since M. Dupasquier, of Lyons, published his interesting work on the protiodide of iron, it has generally been supposed that this chemical compound can be obtained in the solid state, only by operating in contact with the air, a more or less extensive decomposition on the part of the atmospheric oxygen. This oxygen, acting on a portion of the iron which it peroxidèses, liberates a quantity of iodine corresponding to that of the oxygen absorbed, so that the iodide of iron of the shops is now considered as consisting of a mixture, in variable proportions, of protiodide of iron, periodide of iron, sesqui-oxide of iron, and of pure iodine. This supposition is certainly correct: the solid iodide of iron, prepared according to the codex is undoubtedly a chemical compound variable in its intimate composition, and therefore it constitutes an uncertain medicinal agent to which, without any doubt, the neutral iodide

* *Bulletin de Therapeutique.*

of iron,—the basis of the normal liquor of M. Dupasquier,—is preferable.

However, it is not impossible to obtain neutral protiodide of iron in the solid state, even by operating in the air; its preparation is even very easy; it is sufficient for that to procure, by the ordinary means, a concentrated solution of protiodide of iron, and afterwards to evaporate it in a porcelain capsule, containing a certain portion of coarse iron filings, quite free from oxide, or better still, iron turnings, or very fine iron wire. The evaporation should be made with care, and continued until on taking out a small quantity of iodide by means of a glass tube, and depositing it on a cold body, in immediately congeals. When we have arrived at this point of concentration, the protiodide of iron is carefully decanted from the metallic iron which accompanies it, run on a glass or porcelain plate, and immediately introduced into small flasks sealed with emery, very dry, and as much as possible deprived of air, by means of heat. Without this precaution, the protiodide of iron is speedily altered. This saline compound can be advantageously substituted for the normal solution of M. Dupasquier, only when just prepared. The preparation of protiodide of iron by the process which I have described is, moreover, of easy execution; in an hour, several ounces may be procured.

The following are the principal properties of solid protiodide of iron, prepared according to the above process.

It is in more or less thick and very brittle plates, the fracture of which presents some traces of crystallisation, and its color is dark green, verging on brown; its taste is inky and perfectly analogous to that of green copperas. It is extremely deliquescent. Its aqueous solution is greenish. It gives a white precipitate by ammonia, and a bluish white by the yellow cyanuret of potassium and iron. Bruised with starch, it gives no blue color; in a word, it possesses all the characters of the protosalts of iron.

From the above, it results that solid protiodide of iron may easily be obtained, possessing the same chemical composition as that which constitutes the iodo-ferraginous liquor of M. Dupasquier, and capable of serving for the preparation of all the medicines of which that liquid is the basis.

CASE OF POISONING, BY BICHLORIDE OF MERCURY, APPLIED TO AN EXCORIATED SURFACE.*

A Child, two years of age, had, at the bottom of the cutaneous folds of the thigh, so well developed at that age, several small chaps. Its mother was in the habit of sprinkling the denuded surface with the powder of lycopodium. One day, by mistake, she took from the cupboard, which contained this inert medicine, a nearly similar powder, yellowish like it, but hard to the touch; it was, as was subsequently discovered, unpure *corrosive sublimate*. The unhappy mother used it to powder the upper part of the thigh and scrotum of the poor child. The latter immediately uttered piercing cries. In twenty minutes, a brown scar, of four centimetres square, was formed on the parts which had been powdered. Around was an inflammation of a bright œdematous red.

A physician called in, caused the child to be bathed two or three times, and thirty-six hours after the accident it was taken to the hospital.

At this period the scar had become black and dry in the centre and rather humid at the circumference. The child presented no functional disturbance. At the end of forty-eight hours the gums swelled, became painful, and were covered with white pellicles: the breath became fetid, and the submaxillary glands swelled considerably. Gradually, the inflammation extended to all parts of the mucous membrane of the mouth, scars manifested themselves on the gums and on the internal surface of the cheeks, beneath them the flesh was fungoïd and bloody. Afterwards, the jawbone was denuded, and considerable hæmorrhage occurred. The blood swallowed by the child was passed under the form a blackish liquid, once by vomiting, and once by stool. The breath was extremely fetid, and the salivation well characterised. Fever set up only after seven days: the face altered but little before death, when the flesh became flabby, and the skin assumed a dull and greyish color.

Besides, the disorders noticed during life in the vicinity of the ossa maxillaria, it was found, after death, that the stomach contained a considerable quantity of blackish liquid, and that the intestines contained the same matter. The scar on the thigh, still adhering to the deeper parts, was 1 centimetre thick.

This case is interesting in several respects: the mercurial salivation, very uncommon in children, and well characterised in one scarcely two years old, is a remarkable fact. But the most striking peculiarity in this case of poisoning is the persistence and activity of the absorption, notwithstanding the sphacelation of the tissues, touched by the corrosive sublimate.

* *Gazette des Hôpitaux.*

It appears, from the gradual progress of the symptoms, which were developed only after a few days, and which, from the moment of their appearance, did not cease to increase in intensity, that the sublimate, combined with the soft parts of the thigh, under the form of scar, was an inexhaustible source of infection, or exhausted the absorbents in order afterwards to poison the economy. Moreover, this faculty of escharotic poisonous substances, of determining serious toxical symptoms, had already been observed by Dupuytren, Roux, and other surgeons accustomed to using the arsenical paste of Frère Cosme, and that of Rousselot.

A third phenomenon worthy of attention is, the frequency of the hæmorrhage observed in this young child, which is explained by the property which mercurial preparations possess of rendering the blood more fluid, and of enabling it to flow out with much greater facility than in the normal state.

To what was the black coloration of the blood evacuated by the stools and by vomit- and contained in the stomach, attributable? Without admitting, entirely, as has been said, that this coloration was due to the presence of intestinal acids, for the digestive tube below the ventricle contains notably alkaline matter, it should be thought that this cause may act its part; but the state of decomposition of the nutrimentive liquid, and its prolonged stay out of the vessels in contact with the gangrenous detritus, such are, especially as demonstrated by experiment, the circumstances which determined its blackish coloration.

EXTEMPORANEOUS VESICANT.*

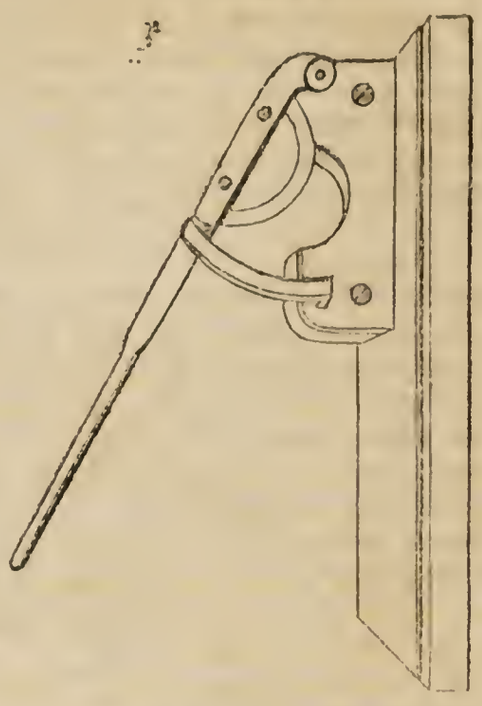
BY DR. DARCQ.

Into a flat watch glass, pour from 8 to 10 drops of very concentrated ammonia; cover the liquid with a large piece of linen on a rather less diameter than that of the glass, and slowly apply this little apparatus to the previously shaved skin. Keep the whole in its place by means of moderate pressure with the fingers.

As soon as a red ring, about 2 *centimetres* in breadth, is observed round the glass, it is certain that vesication is effected. Sometimes scarcely 30 seconds are necessary for obtaining this result. It remains only to remove the apparatus to wash the part, and to tear away with a pair of nippers the epidermis, which comes off easily and in one piece.

The dressing is according to the object in view,—to the indications of the endermic method, for example.

* *Bulletin de Therapeutique.*



THE PHARMACEUTICAL KNIFE.

We have been favoured by Messrs. George Knight and Sons with a sight of the above exceedingly useful knife, which our readers will find extremely well adapted for pharmaceutical purposes. We regret that, at the late period of the month at which this is written, we are unable more fully to detail its advantages. The cut will, however, enable chemists to judge for themselves.

COPPER IN ORGANIC TISSUES.*

BY M. JULIUS ROSSIGNON.

M. Rossignon, of Lyons, has lately addressed a communication to the Academy of Sciences, on the presence of copper in the organic tissues of a great number of vegetables and animals.

It is well known that MM. Danger and Flandin have endeavored, in their last memoir, to establish the non-existence of copper in the human body in its normal state. M. Rossignon proposes in his note to contradict their results, and to confirm the existence of copper in the healthy human body.

His experiments show that copper exists not only in the blood and muscular fibre of

* *Gazette Médicale* and *Medical Gazette*, December, 1843.

man, but in a great number of domestic animals, and in the vegetables on which they feed.

Experiments made on dogs in 1839 showed that copper existed in them. M. Dumas having mentioned in his lectures, that wheat contains an appreciable quantity of copper, which is absorbed by our digestive process, M. Rossignon was induced by his knowledge of this fact to continue his researches on the normal existence of copper in all organised beings, and particularly in the alimentary substances most used by man.

The following are some of the results to which M. Rossignon more particularly directs our attention :—

The *gelatine* obtained by the philanthropic process of the Hôpital St. Louis when carbonised in a close vessel, affords 0·03 of pure copper in 100 parts of carbon.

The *boiled sorrel*, of the green-grocers, affords as much as two per cent. of the neutral oxalate of copper.

Ménier chocolate affords only 0·05.

Bread, from the principal bakers in Paris, gave from 0·05 to 0·08 of copper in 1,000 parts of carbonised bread.

Coffee contains a few atoms of copper.

Succory affords more.

Madder contains a considerable quantity.

Sugar affords a carbon, which, when rigorously analysed, furnishes copper, and sometimes lead.

Barley sugar affords copper.

Fecula sugar, when carbonised, contains as much as four per cent. of copper.

Lastly, M. Rossignon says that, since the memoir of MM. Danger and Flandin, he has found very small but appreciable quantities of copper in human semen, in the excrements of fowls, in eggs, and in the eye of the ox, completely calcined in a close vessel.

PREPARATION OF SYRUP OF GENTIAN.

BY M. E. TAUVEL.

Syrup of Gentian prepared according to the Codex, loses its transparency a few days after its preparation, and becomes very turbid after some time. This syrup, already disagreeable to take on account of its great bitterness, is still more repugnant to the patient, because it has not that agreeable aspect to the eye which seems to contribute greatly to ameliorating its bad taste.

With the view of obtaining a syrup of gentian which retains its transparency without its medicinal properties being weakened, I have adopted the following process for above a year, and it always gives a good product: I have preserved the proportions of the Codex :—

Gentian Root in coarse powder	48 grams.
Cold water.....	*qs.*
Simple Syrup.....	1,500 ,,

The gentian is lixiviated in the displacement apparatus with a sufficient quantity of cold water; the operation is stopped as soon as the liquid which flows out appears less *charged*. The liquor is filtered and briskly mixed with the boiling syrup brought to such a consistence that, the liquor being added to the syrup, the latter marks 30° of the areometer.

By this process, syrup of gentian retains its transparency for an indefinite period; it is quite as bitter, and more aromatic, and possesses more odor than that of the Codex. I have some which has been prepared more than six months, which is as limpid as on the first day.

I have made it comparatively—1st, according to the Codex; 2nd, with extract; 3rd, by the method which I point out. That of the Codex presents the objection already noticed, that of becoming turbid. That mode with extract preserves its liquidity, but it is less odorous than the two others. I need not repeat what I have said concerning the third.

It is known that gentian root is a substance which very difficultly yields to lixiviation, on account of its viscidity; but with a few precautions, by sifting the powder very finely, the difficulties are easily overcome.

MEDICAL PROPERTIES OF CHLORIDE OF MAGNESIUM.*

The following are the conclusions at which Dr. Lebert arrives :—

I. Chloride of magnesium is a very soluble and deliquescent salt, well supported in general, not disagreeable to take, if sufficiently diluted.

II. The average dose, to obtain a purgative effect, is about 32 grammes for an adult and 16 for a child of from 10 to 14 years of age.

III. This salt has no injurious effect on the stomach, and if it sometimes produces uneasiness, it is much less incommodious than most other purgatives.

IV. It has a favorable influence on digestion; its purgative action is followed by increase of appetite.

* *Archives Generales de Médecine*, Dec., 1843.

V. It exerts a stimulant action as well on the secretion of bile as on that of the intestines; the evacuations which it produces are not only copious and liquid, but also in general of a deep color, due probably to the copious effusion of bile.

VI. In general from 16 to 32 grammes produce from 3 to 5 alvine evacuations in the 24 hours, an effect which is sustained even when the salt is continued during 5 or 6 days, and which is then often still more considerable.

VII. The purgative effect ordinarily commences from 1 to 3 hours after the salt is taken.

VIII. The evacuations sometimes follow one another quickly; but the average time is from 3 to 4 hours.

IX. It is a purgative of gentle action and of very certain effect, which should rather be employed when it is wished to produce and sustain a purgative effect during a certain time, than for provoking a very powerful effect, and for a single day.

X. We cannot yet decide in what diseases its employment is proper, the present memoir being intended only to furnish some notions concerning its physiological effect.

EMPLOYMENT OF CHLORIDE OF ZINC IN TOOTHACHE.*

BY DR. STANELLI.

According to Dr. Stanelli, the chloride of zinc, liquified by exposure to the air, possesses the property of calming dental pains.

His mode of application is most simple. By means of a small hair pencil, a small quantity of it is applied to the cavity of the painful tooth, and in the space of a few minutes it appeases the most acute sufferings, without causing any irritation.

Before proceeding to the application, it is indispensable carefully to surround with cotton wadding, and, when the chloride has been applied, to well fill the cavity with this same cotton. The mouth is finally washed with a little warm water.

The author affirms that he has obtained uniform success from this means in more than fifty cases, and that he has never observed the progress of the caries rendered more active by it.

INFLUENCE OF FLOWERS ON HEALTH.

On the 3rd of September, at 10 p.m., I went to bed in a small room, after having placed on the mantelpiece a nosegay of flowers of jasmine as large as an orange; I had a frightful nightmare, and I awoke at two o'clock in the morning in perspiration, with a violent headache, pains in the articulations of the lower limbs, and general uneasiness.

I immediately threw the flowers out of the room, which I aired by opening the door and the windows. I did not completely recover for two days afterwards.

Larue de Barry.

SULPHATE OF QUININE, A CURE FOR RHEUMATIC TETANUS.*

A man, aet. 52, in the habit of sleeping on the damp ground, was seized, on the 8th of February, 1843, with pains of the articulations of the back, and, at the same time, with rigidity of the inferior extremities and with tension of the abdominal muscles. The following days, the patient continued to remain motionless on his bed, with a permanent contraction of the muscles of the trunk and limbs. On the fifth day, the jaw became stiff, and tetanus manifested itself. Several bloodlettings were performed without success; laxatives and purgatives produced no better results. Six days after the appearance of the symptoms, guided by the mode of invasion of the disease, the fever, and the acute pains in the joints, it was decided to prescribe sulphate of quinine in the dose of twelve centigrammes. The stiffness gradually diminished under the influence of this remedy, which was persevered in for more than a month. At the end of that time, the rigidity had successively disappeared from the limbs, the jaw, and the muscles of the abdomen.

This fact is certainly very remarkable; it presents an additional proof in support of the capital distinction which should be established between essential neuroses, which have no essential support in the economy, and those which are connected with another affection of whose nature they partake. In these cases, they are accessible to our therapeutical agents. Thus, epilepsy, connected with an intermittent fever, may be cured by antiperiodics; tetanus, depending on rheumatismal causes, is overcome by sulphate of quinine. A new opening for the investigations of practitioners desirous of extending therapeutics!

* *Annali Universali de Medicina.*

* *Raccogliore Medico*, 1843.

TICKETING PATRONISED BY THE PHARMACEUTICAL SOCIETY.

To the Editors of The Chemist.

GENTLEMEN,—

MAY I be allowed to enquire through the medium of your valuable journal, whether Mr. Baxter, who now figures as a member of the council of the Pharmaceutical Society, is one and the same with the Mr. Baxter, in whose shop window in High Holborn, I observed some short time ago (when in town), goods, the prices of which were ticketed, for instance, "Seidlitz Powders," so much per dozen? If this be the same Mr. Baxter, it really speaks little for the selection of the Council of our Society, which should be most respectable. But I have no wish to condemn any one without a thorough knowledge of their peccadillo, and therefore make this enquiry of you.

Wishing much success to your efforts in our cause, and feeling grateful for your past exertions,

I remain,

Your humble servant,

A Country M.P.S.G.B.

Jan. 3rd, 1844.

P. S. How much hair oil, may it be inquired, does Mr. Cole (a member of the Council), sell before he goes to church on a *Sunday morning*, and how much is sold by his assistants during the service? can any of your correspondents tell?

CASE OF ERGOTISM.*

BY JAMES B. THOMPSON, M.D.

THIS disease, if disease it may be called, is often met with amongst the natives of the western coast of Africa. It was remarkably well marked in the following case:—

The subject was a lad of about eighteen years of age, servant to the brother of Governor Rankin, then residing at the Gambia. It was observed, that whenever this boy was in the act of brushing the flies and mosquitos from his master while at dinner, he dropped off into an apparently sound sleep, and remained fixed in his then position. He was often noticed to do the same when about to get anything from off the side-board, or in opening a closet in the dining-room. It was often amusing, indeed, most laughable, to behold him during this period of somnolency. He was not unlike a person going about the house in his sleep. Indeed, there seems to be some analogy between this affection and that of a confirmed somnambulist; but the former cases are more generally followed by serious, sometimes fatal consequences, after a period of years has elapsed. It would appear as if the circulation in the brain was much engaged; death, in such cases, mostly terminating in a form of asphyxia apoplexy. I am not aware that antopses have thrown any light as yet on the subject; nor do I imagine we are as yet in possession of the most judicious treatment for such anomalous cases.

* *Medical Gazette*, January 19, 1844.

SANTONINE ADULTERATED WITH BORACIC ACID.*

BY M. RUSPINI.

IN proportion as chemistry, by its progress and discoveries, enriches therapeutics with a great number of new products, a mischievous genius is occupied, at the same time, in adulterating the products by the admixture of substances nearly similar in their nature, but which are of no efficacy.

Every one knows to what adulterations, since their discovery, the salts of morphia, of quinine, of iodine, creosote, lactate of iron, &c., have been exposed. It is the same with santonine, the proximate principle of the *semen santonicum*, which, on account of its well-ascertained efficacy as an anthelmintic, is now generally employed.

This substance was first adulterated with gum arabic; and now those who prepare it skilfully mix it with boracic acid.

The following are two processes which I propose for detecting this fraud. These means are based on two different properties which santonine and boracic acid possess.

PURE SANTONINE.

It is melted, at a gentle heat, on a piece of white paper; if it be pure, it should quickly liquify without crepitation, leaving the paper rather greasy, and, on cooling, it crystallises in a mass, of a yellow color.

SANTONINE AND BORACIC ACID.

Melted likewise, at a gentle heat, on paper, it swells up, and slightly crepitates, as salts do when they part with their water of crystallisation. The paper will likewise be greased by the santonine, whilst the acid, deprived of its water, will separate under the form of a white powder.

If santonine contain the smallest quantity of boracic acid, it will color green the flame of alcohol.

* *Journal de Chimie Médicale*, Jan., 1844.

DANGER OF ZINC IN BUILDINGS.

M. D'Arnet has recently shown *(Annales d'Hygiene)* that, in case of fire, the use of zinc as a covering to buildings is attended with considerable danger; and, from its combustibility, he has seen a stove-chimney, made of this metal, burn with frightful rapidity. In a memoir presented to the "Academy of Sciences in the year 1747, we find the following passage, which bears directly on the subject: "Formerly zinc was used to cover the towers of churches; but its use has been discontinued, owing to its having been found dangerous in fires which took place in these churches."*

ON HELENINE.†

BY DR. BICH.

Dr. Bich having exposed to the heat of a baker's oven, in order to dry it, some root of elecampane, and which had attracted moisture from the air, found sublimed, against the sides of the paper with which this root was covered, a substance presenting silky white and very light *bouppes*, presenting the chemical and physical properties of helenine, or camphor of elecampane. He was quite astonished at collecting, under this form, a product which is ordinarily extracted under the form of oil, which *congeals* by distillation, of elecampane, or in crystals by allowing an alcoholic tincture of this root to be saturated while warm.

Dr. Bich, in the hope of obtaining a greater quantity of this product, to which elecampane appears to owe a great part of its medical properties, subjected a root of more recent crop to the same heat, but he obtained no product.

This fact appeared to him the more surprising, as according to the information which he could procure concerning the root which furnished him the sublimate of Helenine, that it was about six years old.

It might be believed that this root elaborates its most active principles during a very long time after its desiccation, and that it may be the same with other roots and aromatic woods. However, may it not also be believed that this root yielded helenine only on account of the commencement of alteration caused by the humidity which it had attracted from the air, by the disaggregation of the cellules containing it, or by the decomposition and destruction of the substances which enveloped it in its intact state?

These facts should fix the attention of pharmaciens, and stimulate them to more ample and more accurate observation.

IV. REVIEWS AND NOTICES OF BOOKS.

LECTURES ON ELECTRICITY, COMPRISING GALVANISM, MAGNETISM, ELECTRO-MAGNETISM, MAGNETO AND THERMO-ELECTRICITY. By Henry M. Noad. A new and greatly enlarged edition. Illustrated by nearly 300 wood-cuts. London: G. Knight and Sons, Foster-lane. 1844. 8vo., pp 457.

The science of electricity, besides having become extremely popular, from the striking beauty of its phenomena, is likely ultimately to vie with chemistry in the usefulness of its applications in the arts, and in which, indeed, great and wonderfully rapid progress has already been made. It has already been applied to the art of gilding and plating, and that with great success. The electrotype will hand down to succeeding ages the name of Spencer. The electric clock and the electric telegraph are also instances of the practical application of electricity to mechanical purposes. This agent has also been proposed as a means of propelling vessels, the use of steam power and its contingent inconveniences and expense (among the greatest of which may be mentioned the necessity of carrying about enormous quantities of coal) being thus avoided. In metallurgy, its value has been well recognised.

These are some of the most important applications of electricity in the arts; and that, in a very few years, its utility will be far more widely extended, there can be not the slightest doubt. We are but beginning to appreciate its capabilities.

We need not remind our readers of its value in chemistry, as a decomposing agent, &c.

Under these circumstances, then, we cannot but regard with satisfaction the appearance of a work wherein the principles and laws of electricity are clearly explained and fully developed, and by which an acquaintance with this science is placed within the reach of the most ordinary capacity; such is

* *The Lancet*, Jan. 13, 1844.

† *Journal de Pharmacie*, January, 1844.

the book before us, which amplitude of detail, clearness of definition, easy diction, and avoidance of too abstruse technicality, combine to render *comprehensible* as well as useful:—

"It was in the year 1749 that the celebrated American philosopher Franklin, in a letter to Mr. Collinson, stated fully his reasons for considering the cause of electricity and lighting to be the same physical agent, differing in nothing save the intensity of its action. "When," says he, "a gun-barrel, in electrical experiments, has but little electrical fire in it, you must approach it very near with your knuckle before you can draw a spark; give it more fire and it will give a spark at a greater distance. Two gun-barrels united, and as highly electrified, will give a spark at a still greater distance. But if two gun-barrels electrified, will strike at two inches distance, and make a loud snap, to what a great distance may ten thousand acres of electrified cloud strike, and give its fire, and how loud must be that crack?" He next states the analogies which afford presumptive evidence of the identity of lightning and electricity. The electrical spark is spark is zig-zag, and not straight; so is lightning. Pointed bodies attract electricity; lightning strikes mountains, trees, spires, masts, and chimneys. When different paths are offered to the escape of electricity, it chooses the best conductor, so does lightning. Electricity fuses metals; so does lightning. Electricity fires combustibles; so does lightning. Lightning rends bad conductors where it strikes them; so does electricity when rendered sufficiently strong. Lightning reverses the poles of a magnet; electricity has the same effect. A stroke of lightning, when it does not kill, often produces blindness; Franklin rendered a pigeon blind by a stroke of electricity intended to kill it. Lightning destroys animal life; the American philosopher killed a turkey and a hen by electrical shocks.

"It was in the June of 1752, that Franklin made his memorable experiment of raising a kite into a thunder-cloud, and drawing from it sparks, with which Leyden jars were charged, and the usual electrical experiments performed. A month earlier, it appears that a French electrician, M. Dalibard, following the minute and circumstantial directions given by Franklin in his letters to Mr. Collinson, obtained sparks from an apparatus prepared at Marly-la-Ville: and an attempt has lately been made by M. Arago to claim for this philosopher, and Nollet, the honor of having established the identity of lightning and electricity: it is clear, however, that the just right belongs to Franklin, for, although this eminent electrician was a month later in his capital experiment than Dalibard, it was nevertheless at his suggestion, and on his principles, that the arrangements of the Frenchman were made: and, indeed, if the honor of the discovery is to be given to the individual who first obtained sparks from an atmospheric apparatus, it belongs neither to Dalibard, nor to Franklin, but to an old retired soldier and carpenter, named Coffier, who was employed by Dalibard to assist him in his experiments, and who actually first drew a spark when the curé was absent.

"The analogy between the electric spark and lightning was noticed at an early period in electrical science. In 1708, Dr. Wall mentioned a resemblance of electricity to thunder and lightning. In 1735, Mr. Grey conjectured their identity, and that they differed in *degree* only; and in 1748, the Abbé Nollet re-produced the conjecture of Grey, attended with more substantial reasons. Now, if, as was somewhat whimsically asserted by Arago, "the whole affair of the experiment was useless, the flame on the javelins of the Roman sentinels, of the fifth legion, and the Castor and Pollux so often seen by sailors on their mast tops' being sufficient as experiments," then the credit of the discovery is due to Stephen Grey, who first conjectured the identity between electricity and lightning (see the excellent historical sketch of electricity in the first volume of Dr. Lardner's *Manual of Electricity*, and *No.* 130, *Cabinet Cyclopædia*).

"The following is the account transmitted to us of Franklin's bold experiment:—He prepared his kite by making a small cross of two light strips of cedar, the arms of sufficient length to extend to the four corners of a large silk handkerchief stretched upon them; to the extremities of the arms of the cross, he tied the corners of the handkerchief. This being properly supplied with a tail, loop, and string, could be raised in the air like a common paper kite; and, being made of silk, was more capable of bearing rain and wind. To the upright arm of the cross was attached an iron point, the lower end of which was in contact with the string by which the kite was raised, which was a hempen cord. At the lower extremity of this cord, near the observer, a key was fastened; and, in order to intercept the electricity in its descent, and prevent it from reaching the person who held the kite, a silk ribbon was tied to the ring of the key, and continued to the hand by which the kite was held.

"Furnished with this apparatus, on the approach of a storm, he went out upon the commons near Philadelphia, accompanied by his son, to whom alone he communicated his

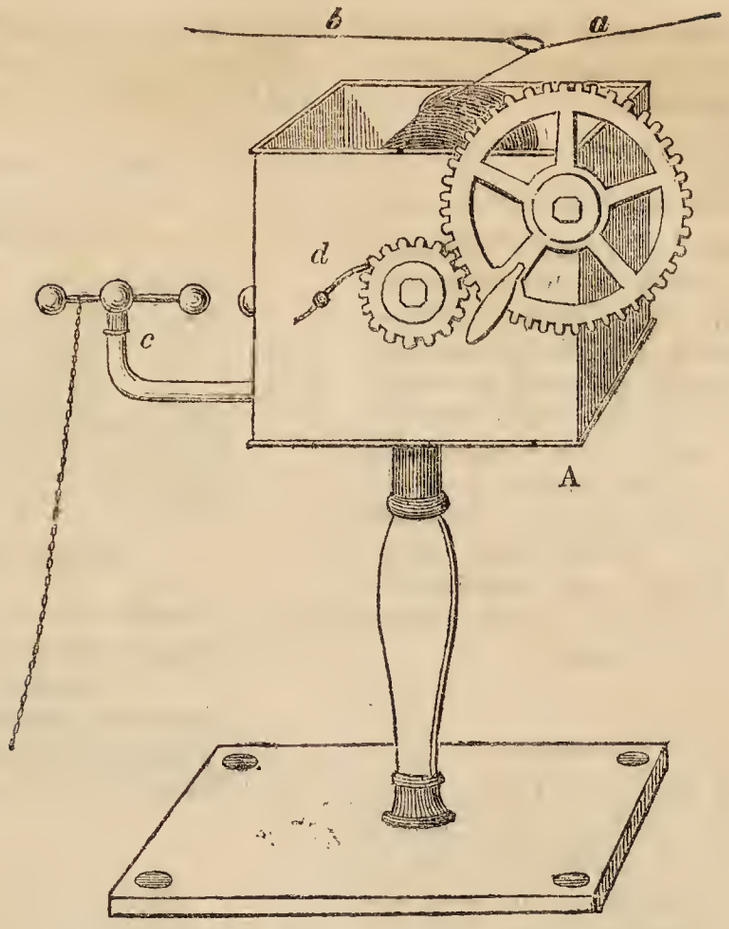
intentions, well knowing the ridicule which would have attended the report of such an attempt should it prove to be unsuccessful. Having raised the kite, he placed himself under a shed, that the ribbon by which it was held might be kept dry, as it would become a conductor of electricity when wetted by rain, and so fail to afford that protection for which it was provided. A cloud, apparently charged with thunder, soon passed directly over the kite. He observed the hempen cord, but no bristling of its fibres was apparent, such as was wont to take place when it was electrified. He presented his knuckles to the key, but not the smallest spark was perceptible. The agony of his expectation and suspense can be adequately felt by those only who have entered into the spirit of such experimental researches. After the lapse of some time he saw the fibres of the cord near the key bristled, and stood on end. He presented his knuckle to the key and received a strong bright spark. *It was lightning.* The discovery was complete, and Franklin felt that he was immortal!

"A shower now fell, and wetting the cord of the kite, improved its conducting power. Sparks in rapid succession were drawn from the key; a Leyden jar was charged by it, and a shock given; and, in fine, all the experiments which were wont to be made by electricity were reproduced, identical in all their concomitant circumstances.

"Franklin afterwards raised an insulated metallic rod from one end of his house, and attached to it a chime of bells, which, by ringing, gave notice of the electrical state of the apparatus."

These interesting experiments were eagerly repeated in almost every civilised country, with variable success. In France a grand result was obtained by M. de Romas: he constructed a kite seven feet high, which he raised to the height of 550 feet by a string, having a fine wire interwoven throughout its whole length. On the 26th of August, 1750, flashes of fire, ten feet long, and an inch in diameter, were given off from the conductor. In the year 1753, a fatal catastrophe from incautious experiments upon atmospheric electricity, occurred to Professor Richmann, of St. Petersburg; he had erected an apparatus in the air, making a metallic communication between it and his study, where he provided means for repeating Franklin's experiments: while engaged in describing to his engraver, Tokolow, the nature of the apparatus, a thunder clap was heard, louder and more violent than any which had been remembered at St. Petersburg. Richmann stooped towards the electrometer to observe the force of the electricity, and, "as he stood in that posture, a great white and bluish fire appeared between the rod of the electrometer and his head. At the same time a sort of stream of vapor arose, which entirely benumbed the engraver, and made him sink on the ground." Several parts of the apparatus were broken in pieces and scattered about; the doors of the room were torn from their hinges, and the house shaken in every part. The wife of the professor, alarmed by the shock, ran to the room, and found her husband sitting on a chest, which happened to be behind him when he was struck, and leaning against the wall. He appears to have been instantly struck dead; a red spot was found on his forehead, his shoe was burst open, and a part of his waistcoat singed; Tokolow was at the same time struck senseless. This dreadful accident was occasioned by the neglect on the part of Richmann to provide an arrangement by which the apparatus, when too strongly electrified, might discharge itself into the earth, a precaution that cannot be too strongly urged upon all who attempt experiments in atmospheric electricity.

The experiments with the electrical kite are very interesting, but great caution is required in conducting them. When thunder clouds are about, the string should never be allowed to pass through the hand while raising the kite, even though it have a good connection with the ground: indeed, even under a cloudless sky, during a smart north-east breeze, I have frequently experienced very unpleasant shocks whilst letting out the string. By employing, however, the little apparatus shown in figure 68, complete security is ensured, and I strongly recommend it to the notice of kite experimenters. A, is a square copper box supported on a stout glass pillar (not less than two inches thick), and firmly cemented into a base-board, which is secured to the ground by strong iron pegs nine inches long, passing through the holes, and driven into the ground. The box contains a reel, round which the wired string is wound; it is turned by a glass handle fixed on the multiplying wheel. *d* is a small catch moved by a key furnished with a glass handle, by which the reel may be stopped when required, without touching the string. *c* is a Lane's electrometer provided with a screw-adjustment, by which the distance between the brass balls may be regulated with the greatest nicety; it is connected with the ground by a chain or wire. The method of using this apparatus will immediately be understood. When the kite (which may be simply a silk handkerchief, stretched on a cross of light wood) is raised a sufficient height from the ground for the wind to act upon it, the string need no longer be held in the hand, the kite draws it from the reel, and the ex-



perimenter, by means of the catch and key, has it under his complete control. When a sufficient quantity of string has been taken out, a silk cord, two or three yards long, is thrown over the string, and by means of a running noose, tightened upon it, and the other end made fast to a post; by this means the strain is taken off the box.

On ordinary occasions, that is, when no unusual exhibitions of electricity are anticipated, I generally set the balls of the discharger about one-fifth of an inch apart, and, instead of connecting the sliding wire with the earth, put it in communication with the interior coating of a Leyden phial. In a few minutes sparks pass between the balls, and on dry days, when the wind is in the north or north-east, with about half a mile of wired string out, I have frequently had discharges at the rate of one a minute from the jar, through a striking distance of one-fourth of an inch, for hours together. In order to test the species of electricity collected, I cause the jar to discharge through a helix of copper wire, enclosing a needle: after five or six explosions have passed, the needle becomes magnetised, the direction of the poles indicating the manner in which the jar was charged. If the helix be a *right*-handed one, that is, one in which the convolutions take the same direction as that in which the hands of a watch move, then, if the jar be charged *positively*, that extremity of the needle lying in the coil which is nearest to the *negative* or outside coating of the jar will become a north pole. If the helix be left-handed, the results are exactly the reverse.

It is most interesting and instructive to watch the effect of clouds passing near the kite, their presence being invariably indicated by the increased rapidity of the discharges between the balls; the distance at which the electricity is communicated is indeed astonishing. I have frequently observed a very marked alteration in the discharges from the approach of a single and small cloud before it could have reached within half a mile of the kite; and I have often astonished bystanders who have been amusing themselves by drawing small sparks from the string with their knuckles, by watching the opportunity presented by the approach of one of these clouds, and then desiring them to repeat their experiment, and the result has generally been a shock which has taught them to treat the apparatus with far greater respect than before.

One of the first things that the kite experimenter will probably notice is the peculiar pungency of the spark: we are accustomed to receive sparks an inch long from the prime conductor of an electrical machine for amusement; it would not, however, be safe to approach a kite string from which sparks of such a length might be drawn. The shocks from sparks half an inch long are generally very severe, and resembling more the shock from a highly charged Leyden phial, than that from the prime conductor: the length of the spark is not, however, altogether the criterion of the intensity of the electricity, which depends upon the quantity of string extended, and more still upon the state of the atmosphere.

This work will be found invaluable to those who are about to commence the study of the science of electricity.

JAMES' FEVER POWDER.

Mr. J. L. Kiddle, of Lamb's Conduit-street, has sent us a bottle of this celebrated sudorific. We have taken some ourselves, and have administered it to others; and we have no hesitation in attesting its efficiency. Mr. K. has conferred on the public an inestimable benefit by selling it at a reasonable price, 4s. 6d. per oz., thus putting it within the reach of the poorer classes. We are by no means advocates of the cheap medicine system; but in this case, the price is reduced to fairness, while the article sold is *honestly* and *properly* prepared.

LACTATE OF IRON.

We have received from M. Duhamel, of Duke-street, Grosvenor-square, a box of his *dragées minerales* and *pastilles de lactate de fer*. These preparations of iron are almost without ferruginous taste, and we have found them exceedingly efficacious. We recommend them as by far the best forms of administering iron.

BOOK RECEIVED.

An Inquiry into the Nature of the Simple Bodies of Chemistry. By David Low, F.R.S.E., Professor of Agriculture in the University of Edinburgh. London: Longman and Co. Edinburgh: A. and C. Black, 1844.

TO CORRESPONDENTS.

Great pressure of business has compelled us, reluctantly, to delay answering by post the queries of several correspondents: however, they will be answered by the 2nd inst.

V. de P.—Your letter was, unfortunately, too late. Will you favor us with the means of addressing you?

Mr. Brown.—Answered by post.

If a "Subscriber," who writes on the subject of the study of medicine, &c., will send us the means of addressing him, he shall have the best advice we can offer.

A. B.—Send your address.

We will endeavor, if other engagements permit, to comply with "A Tradesman's" request.

SUMMARY OF METEOROLOGICAL OBSERVATIONS MADE AT OTLEY, YORKSHIRE, IN DECEMBER, 1843.

BY E. THOMPSON.

BAROMETER.

Monthly mean	30·09
Mean at 9 a.m.....	30·10
,, 3 p.m.....	30·09
,, 9 p.m.....	30·09
Maximum on 18th ..	30·30
Minimum on 5th	29·69
Range	·61

THERMOMETER.

Monthly mean	41°
Mean of maxima	43
,, minima.....	39
Maximum on 18th	52
Minimum on 6th.....	29
Range.....	23

WIND.

Days.		Days
N. 0		S. 0
N. E. 0		S. W. 18
E. 0		W. 7
S. E. 0		N. W. 1

RAIN.

0·26 inches.

WEATHER.

	Days.		Days.
Clear.....	1	Frost.....	3
Cloudy	11	Hoar frost....	1
Overcast	10	Misty.....	2
Showers	4		
Snow	0		

GENERAL REMARKS.

Uniformity of temperature and pressure has been the characteristic of this month, and fair cloudy weather has generally prevailed. There have been only three frosty nights, and scarcely one-fourth of an inch of rain has fallen during the period. From the frequency of cases of severe disease, and especially infantine complaints, we may infer that such unseasonably mild weather has not been favorable to health.

Nota Bene.—*All Communications, Books for Review, and Substances to be Analysed, must be addressed "To the Editors of the Chemist, 310, Strand, London." Communications must be prepaid, and sent before the 15th of each month; Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

ON THE CONSTITUTION OF SALINE BODIES, WITH SOME REMARKS ON DR. HARE'S VIEWS OF THE SUBJECT.

BY REUBEN PHILLIPS.

The word salt was originally confined to what chemists now call chloride of sodium, or common salt—a substance which has been known in common from the remotest ages. The term was afterwards generalised by chemists, and employed by them in a very indefinite sense. Every body which is sapid, easily melted, soluble in water, and incombustible, was classed among the salts.

Salts were considered by the older chemists as substances intermediate between earths and water; and, as in these days, many disputes arose as to what bodies ought to be comprehended under this class, and what excluded from it. All allowed the acids and alkalis to be salts; but the difficulty was, into what class to put the earths and metals; for they found many of the earths to possess all the properties which have been ascribed to salts, and metallic bodies are capable of entering into combinations which possess saline properties.

In process of time, however, the term salt was restricted to three classes of bodies,—namely, to the acids and alkalis, and to the substances which acids produce with the earths, alkalis and metallic oxides. The acids and alkalis were called simple salts; the salts belonging to the third were called compound or neutral. This last appellation originated from an opinion long entertained by chemists, namely, that the acids and alkalis, from which such salts are produced, are of a contrary nature, and that they counteracted one another; consequently, the resulting compounds were possessed of the properties of neither acids nor alkalis, but properties intermediate between the two. Chemists subsequently restricted the term salt still more, by tacitly excluding acids and alkalis from the class of salts.

On the eve of Sir H. Davy's discoveries, the definition of a salt was, any compound formed by the union of any acid with any alkali, earth, or metallic oxide. Davy taught chemists to modify their views: he shewed that the so-called muriates—compounds of muriatic acid with metallic oxides, are chlorides; that is, compounds of chlorine with metals: and since he shewed chlorine not to be an acid, and since metals are not alkalis, it follows that in the dry state this class of salts contain no acid nor alkali. Gay Lussac shewed that as much might be said of the cyanides, or, as they were formerly called, *prussiates*. Here, then, are many salts which contain neither acid nor alkali.

Davy had shewn chloric acid to be a compound of $O^6 + Cl + H$, and chloride of potassium to be $O^6 + Cl + K$, of which he remarked, that the only difference in the ultimate constitution of the two compounds consists in its containing in one case hydrogen, which, when replaced by potassium, forms the salt called chloride of potassium. He shewed that the same views might be applied to a variety of other compounds. But, notwithstanding the beautiful simplicity of these views, chemists were slow to adopt them; and it is only lately, and after the existence of a great number of polybasic acids has been discovered, to the constitution of which these views supply the only key, that they have been generally adopted.

Having thus taken a short review of the past, we come to consider a point relative to which a controversy now exists, namely, whether or not salts ever consist of acids

and oxides; that is, if, when dissolved in water, they preserve the same constitution as in the solid state.

The principal arguments in favor of the opinion that aqueous saline solutions consist of a radical and metal, are derived from the electrolysis of saline solutions. Faraday has shewn that none but binary compounds are electrolytes. Now, since it can be shewn that salts, as sulphate of soda, for example, can be decomposed by an electric current, it hence follows that it is a binary compound: this may either be $SO^4 + Na$, or $\overline{SO^4 + H} + NaO$. By separating the solution by a diaphragm interposed between the electrodes, it is observed, that in the side of the cell where the anode is, there is produced, for every equivalent of oxygen there delivered up, an equivalent of acid; and also, at the cathode, for every equivalent of hydrogen produced, there is an equivalent of alkali. If, now, the current which passes through this saline solution be passed through a voltameter, there will be the same quantity of hydrogen liberated in the voltameter as produced in the decomposing cell. Now, Faraday has shewn that any quantity of electricity passing through these decomposing cells, under these circumstances, must produce the same effect in each. We see that the production of hydrogen and oxygen is the same in both cases: therefore some or all of the substances liberated in the sulphate of soda cell must be produced by some secondary action, otherwise there is twice as much work performed in one cell as there is in the other, by the same power, which is absurd.

According to the theory which assumes that sulphate of soda and like salts are represented when in solution by radical + metal, this electrolytic action admits of a happy explanation, in this manner:—that for every equivalent of the mixed gases liberated in the voltameter, one of the radical, in this case SO^4, and one of metal, in this instance sodium, are produced; but in this case the radical SO^4 is assumed incapable of a separate existence, and therefore resolves itself and an equivalent of water into $\overline{SO^4 + H}$ + free oxygen; and the sodium at the cathode forms, with an equivalent of water, soda and hydrogen. If, now, this salt of sodium be replaced by another, the metallic basis of which is incapable of decomposing water, then should the metal be obtained in the metallic form, and no hydrogen should be liberated. And, accordingly, when sulphate of copper is used instead of the sulphate of soda, the substances produced at the anode continue the same, but at the cathode, for an oxide and hydrogen, metallic copper only is obtained.

Dr. Hare seems to consider that these are the chief reasons which have induced many chemists to regard it as certain that the saline constitution is represented in all cases by radical + metal; and at first sight the experiments may seem to justify that conclusion. For only let us attempt to explain them on the supposition that sulphate of soda in solution is oxide of sodium + sulphuric acid: then, as before, for every equivalent of water decomposed in the voltameter, one equivalent of salt is decomposed; that is, we have on the anode side of the cell sulphuric acid, and on the cathode, its equivalent of alkali: but this does not accord with experiment, as, in addition to this, there must be an equivalent of oxygen and hydrogen, which, on this supposition, are not obtained.

But Dr. Hare has shewn that the beforementioned experiments are perfectly reconcilable with the notion that sulphate of soda consists of sulphuric acid and soda. In lieu of the assumption that the radical SO^4 is incapable of a separate existence, he assumes, that when sulphate of soda is submitted to electrolysis, the soda alone is the object of attack. But this supposition implies another, as we shall presently see.

Imagine a line of particles of sulphate of soda, each atom of which consists of two atoms $\overline{SO^4 + H}$, and NaO; imagine, then, that an electric current be transmitted, the soda contained in the sulphate being the substance by the aid of which the current passes. Then, at the anode, the oxygen of the soda becomes delivered up, while the sodium passes on from one particle of sulphate of soda to the next, until it at last reaches the cathode, where it is rendered in the metallic state, and instantly acts on the solution, forming soda and hydrogen; while the sulphuric acid remains at the anode by reason of its *vis inertia*. If sulphate of copper be substituted for the soda salt, then, because the metal given up at the cathode is incapable of decomposing water, no hydrogen is obtained, but at the anode sulphuric acid is still produced.

Therefore, we see that there is no necessity for concluding that the saline solutions must consist of radical + metal, while we have Dr. Hare's theory of the electrolysis of such bodies. But, as before said, his primary assumption implies another, which I proceed to explain.

During the electrolysis of water and such like simple combinations, it may be conceived that oxygen is liberated on the anode, while the hydrogen passes on to the cathode; or hydrogen may be first produced on the cathode, and the oxygen may pass on from molecule to molecule to the anode; or both

effects may be simultaneously produced. Let us consider these cases separately on a solution of sulphate of soda, supposing it radical + metal. In the first case, then, imagine a line of such particles extending between the electrodes; on the transmission of the current, a particle of the radical is given up on the anode, while the metal passes on to the cathode: this case, then, agrees with previously admitted facts; for the radical evolves oxygen, and the metal liberates hydrogen: supposing the decomposing cell separated by a diaphragm, there would remain in the anode side of the cell a constant quantity of radical, with a diminishing quantity of sodium; and on the cathode side, the radical would also be a constant quantity, while the sodium would be increasing. In the second case, the radical, passing from the cathode to the anode division, would cause an increase of radical in the latter division, which would be accompanied by a corresponding loss of acid from the cathode side: the evolution of gas will be the same as in former case.

In the third case, which is compounded of the former two, there would be, by the first case, an increasing quantity of metal in the cathode division; and, by the second case, an increasing quantity of radical in the anode part of the cell. Hence is this theory applicable to either of these cases.

Let us now examine Dr. Hare's theory on this point. The first case has been already considered, and shewn to be consistent with facts. For the consideration of the second case, conceive a number of molecules of sulphuric acid + soda extending between the electrodes; on the formation of the current (bearing in mind that the soda is the only body to be acted on) the sodium becomes liberated at the cathode, while the oxygen passes on from atom to atom as far as the anode. The products of such an action should be oxygen and hydrogen only; for the sulphuric acid having no cause for moving, must remain in the place where the destruction of the equivalent of sulphate of soda took place, which would again unite with the soda. This does not accord with experiment, and must therefore be considered untrue.

For the consideration of the third case, imagine the same chain of molecules of sulphuric acid + soda: according to this case, at the anode there are produced sulphuric acid and oxygen, and a particle of sodium, which we conceive as going on to the cathode: at the cathode, there are produced sulphuric acid and sodium, and an equivalent of oxygen, which is delivered at the anode. The products of such an action would be twice the number of equivalents of gaseous matter, as compared with the acid and alkali produced, which does not accord with experiment.

Here, then, Dr. Hare's theory fails to be so comprehensive as the one advocated in this country; for it requires the additional assumption, that the first case is the true one. But, certainly, this can be considered as not at all justifying us in rejecting it as untrue.

But it has been rendered certain by Professor Daniell, that if such a saline solution as sulphate of soda be subjected to electrolytic action, the acid produced with the oxygen at the anode does not arise solely from the subtraction of sodium; but that for every two equivalents of oxygen there delivered, one of acid is transferred thither from the cathode division of the cell, and that for every two equivalents of hydrogen delivered at the cathode, one equivalent of sodium is transferred from the anode. Now, it has been before shewn that Dr. Hare's theory will account for the production of the sulphuric acid, oxygen, hydrogen, and sodium in their equivalent proportions; but how shall we so adjust the theory that it may embrace this fact of the transfer of the acid and alkali? If it be assumed that two simultaneous decompositions are produced, namely, the resolution of the sulphate of soda $\overline{SO^4} + H + \overline{Na\,O}$ into sulphuric acid, which is taken to the anode, and soda, which is evolved at the cathode, on the one hand, and on the other, that the soda is acted on as before,—this will, indeed, explain all as regards the liquid products of the electrolytic action; but is deficient, inasmuch as it gives only one-half of the gaseous products required. For, in this case, for every volume of gas produced in the voltameter, only one-half of such volume will be liberated in the decomposing cell; since one-half of the electric current which passes through the voltameter is transmitted through the cell, by means of the sulphuric acid + soda, which can produce no gaseous matter.

Now, we have before seen that the theory which considers salts in solution as radical + metal, explains this action with admirable simplicity, which no other theory yet proposed can in any way do: hence, as an unavoidable conclusion, we must either adopt Professor Daniell's hypothesis, or be contented with none.

As to the oblique, and what I may perhaps call chemical, evidence brought forward by the American Professor, in defence of his views, it is now, I think, needless to meddle with them: such reasons, both for and against, may evidently be regarded as equal, which is proved by the fact, that chemists have been in the possession of such arguments for many years, and yet could never

bring themselves to think alike on the subject.

Relative to the term salt, Dr. Hare observes, that it is impossible to draw the line of demarcation between the oxides, chlorides, sulphates, &c. Therefore I think, that if the term salt be retained, its definition will be, any electrolyte, or any body on which, if we could confer fluidity, would be an electrolyte.

It is curious thus to see ourselves again embracing the opinions of the older chemists, which, for so long a time, were regarded as having no foundation on matter, namely, that acids and alkalis, and those bodies commonly called salts, all belong to the same class.

The train of experiments and reasoning which have been employed to develope the knowledge of the constitution of saline solutions, is capable of shewing, upon like grounds, whether or not acids must be regarded as radical + hydrogen.

As to the change of nomenclature which these notions require, I respectfully suggest that the word expressing the radical portion of a salt be the same in every respect as that now used to indicate the acid; the termination of the base being changed from *a* to *um*; as for sulphate of soda for example, sulphate of sodium. In speaking of the radicals, as for instance, the oxysulphion of Daniell, we may say the radical of the sulphates; a sulphate being explained to mean any combination of the radical O^4S with a metal. Such a nomenclature would be consistent, and differ but little from that now in use.

ON THE PRODUCTION OF THE OXIDATION OF PROTEIN IN THE ANIMAL ORGANISM.*

BY J. G. MULDER.

Fibrin, albumen, and caseïn are, as I have already demonstrated, essentially different bodies. They differ in their proportion of sulphur and phosphorus; but they contain the same principle, proteïn, the knowledge of which must one day give the key to the transformation of the greater part of the most important substances of the animal body; but this time is not yet arrived, since the knowledge of this body is of recent date and imperfect.

The reader will find several data for this study in the following memoir. In order that it may be better understood, we will in a few words explain its contents:—

1. The tritoxide of proteïn always exists in the animal body.

2. It is produced in the lungs by proteïn and the oxygen of the air, and runs through the arteries: proteïn thus forms in some measure an aliment for the oxygen absorbed by respiration.

3. There exists a much larger quantity of it in inflammations: its presence seems to be the condition of inflammation.

4. It is generally produced by fibrin and albumen (probably also by caseïn) in very different circumstances, but only when oxygen is found in contact with these matters, that is to say, during ebullition, exposure to the air, &c.

5. M. Bouchardat has confounded this body with gelatin.

M. Bouchardat has indeed endeavored to demonstrate that fibrin is formed of a combination of proteïn and gelatin; and M. Dumas hastily drew from it some conclusions. Although M. Dumas some weeks afterwards retracted his opinion and his ideas concerning the presence of gelatin in fibrin, he published analyses of this principle. But in these analyses there is an error in the proportion of carbon, amounting to at least 3 per cent. The following are the results:—

	I.	II.
Carbon.....	47·68	48·15
Hydrogen....	6·77	6·97
Nitrogen.....	15·04	14·87
Oxygen.....	30·51	30·01
	100·00	100·00

According to M. Bouchardat, fibrin gives gelatin when boiled with water. He took for this purpose false membranes and buffy coating of the blood; and although he says, "*in the normal state, in the fibrin of man in health, it is sometimes difficult clearly to establish the presence of gelatin,*" fibrin should nevertheless give gelatin; and, according to Dumas, it should always furnish more nitrogen and less carbon than albumen.

Those who read with impartiality the description of the investigations made on this subject, or who will repeat them without prejudice, will not find gelatin in the fibrin of healthy men and animals; but they will extract from them in different circumstances a body which, differing from gelatin, contains much less nitrogen and more carbon than this latter body, which is of the highest importance in the study of animal life.

Two things must be distinguished in the investigations of M. Bouchardat: the fibrin of healthy individuals, and the pathological products regarded as fibrin, or which are partially formed of it. Bouchardat found in healthy fibrin so small a quantity of

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* *Annalen der Chemie und Pharmacie.* Vol. XLVII.

gelatin, that it was sometimes difficult to recognise its presence; but he always observed it in buffy coatings and false membranes. We shall see the results furnished by healthy fibrin.

False membranes should necessarily contain gelatin. The following is the analysis of a false membrane which I published in 1836.

Cellular tissue	1·4
Fibrin	28·6
Gelatin ..... } Extract of meat .... }	70·0
	100·0*

A deposit of fibrin should be made in the inflamed serous membranes, and they should preserve some remains of the tissue of the serous membranes. The diaphragm gives gelatin by boiling, and the false membranes which are formed from it by inflammation should consequently furnish more or less gelatin. It will always be thus in the inflamed portions of the cellular tissue; but the discovery of gelatin in these tissues appeared to Bouchardat equally worthy of remark, whilst the contrary would be very extraordinary.

A pathalogical act in a tissue, and which destroys all that which existed in the healthy tissue, will be most rare.

With respect to the buffy coating, the investigations undertaken, and continued with much care, at my invitation, by J. W. Von Baumhauer, shew that gelatin was not found in it.

According to the indication of M. Bouchardat, the buffy coat is freed from the serum (and consequently from albumen) by washing under water, and boiled with three times its weight of water, until half the water is evaporated, and it is filtered. The cooled liquor gives an abundant precipitate with neutral acetate of lead; the filtered liquor, which contains an excess of salt of lead, allows a fresh quantity of organic matter to separate, where sufficient ammonia is added to it to neutralise the free acetic acid. There is then formed a great quantity of the same salt of lead which is first formed by the neutral acetate of lead. Hence it results, that the decoction of the buffy coating does not contain gelatin. If it be wished to have, in the state of purity, the principle soluble in water, obtained by boiling the buffy coating, the product evaporated to dryness must be treated by alcohol. There is thus dissolved, with a trace of grease, a small quantity of a mixture which will be examined further on. The analysis of the substance of the buffy coating, soluble in water, gave Von Baumhauer, after treatment by alcohol and dessiccation, at 248°F., the following results:—

0·102 gave 0·008 of ash.

0·512 gave 0·880 of carbonic acid, and 0·287 of water.

Carbon	5·48
Hydrogen	6·56

It had all the properties, soluble in water, obtained by the ebullition of fibrin and albumen, and of which I will give, further on, a detailed description. It contains about 15 per cent. of nitrogen.

Without giving here an explanation of the mode in which this body is formed, it may be sufficient for me to declare that it is not gelatine. The latter contains indeed—

		Atoms.
Carbon	50·37	13
Hydrogen	6·33	20
Nitrogen.....	17·95	4
Oxygen	25·36	5

Now, it was important to know whether the buffy coating submitted in this state to elementary analysis, gives results intermediate between those of fibrin and of the body which has just been indicated. Its quantity varies, perhaps; but in proportion as more of it is formed in combination with fibrin, the proportion of carbon and nitrogen should be less than in this latter. I here give some analyses made by Von Baumhauer, of buffy coatings, which were washed for a long time in cold water, in a state of fine division, and then treated by alcohol. Consequently, they contain neither albumen nor fatty matter.

I. 0·2795 of buffy coating of a pleuric patient gave—

0·0035 of ash.

0·2775 gave 0·5235 of carbonic acid, and 0·174 of water.

0·359 and 0·003 of ash.

0·624 and 112·2 c. c. of nitrogen, at 50° F., and 752 mm. before the experiment, and 1912 c. c. at 50·5° F., and 755 mm. after the experiment.

II. 0·426 of buffy coating of the blood of the horse* gave 0·0025 of ash.

0·368 gave 0·701 of carbonic acid, and 0·232 of water.

0·554 gave 1·0495 of carbonic acid, and 0·3425 of water.

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* The following investigations shew that we must read, in this analysis, *binoxide of protein* in place of fibrin, and that the substance indicated as gelatin contains a tritoxide of protein.

* A buffy coating is ordinarily observed in the blood of the horse, even in healthy animals; it is a peculiarity which merits attention.

These numbers correspond in 100 parts to—

	I.	II.	
Carbon....	52·53	52·95	52·68
Hydrogen..	6·93	7·04	6·90
Nitrogen ..	15·51		
Oxygen ..	25·03		

Account must also be taken of the proportion of sulphur and phosphorus which was not determined. It is evident, from the results quoted, that the buffy coating submitted to examination was a mixture of fibrin, or of a body which will be investigated, and of the substance soluble in boiling water. It has been seen, by the ebullition of one part of the buffy coating with water, that a great quantity of the latter substance is found in it. 8·689 of the buffy coating of a pleuritic patient, humid, well washed with water, but not heated by alcohol, gave to Von Baumhauer, after an ebullition of a quarter of an hour with water, and dessiccation at 248° F. :—

Substance soluble in water	0·203
,, insoluble ,,	1·220
Water.....	7·266
	8·689

Consequently in 100 parts :—

Substance soluble in water	14·2
,, insoluble ,,	85·8
	100·0

However, it is probable that an ebullition of a quarter of an hour does not remove all. But, at all events, *from this fact, and this other*, that fibrin gives, by boiling for a quarter of an hour, traces of the substance soluble in water, it results that the buffy coating is entirely different from fibrin. It is, however, possible that the quantity varies in different buffy coatings. Now, the following is the result of these examinations :—

The buffy coating contains a peculiar body, differing from fibrin, albumen, caseïn, as well as gelatine and chondrin : the buffy coating cannot, therefore, be compared with fibrin, as has been done. It contains, with fatty matter,* albumen and a body insoluble in water, a substance which has not hitherto been observed in the animal body, and the study of which is explained further on. It is the same substance which is extracted as a product of the oxidation of protein, from fibrin and albumen, by ebullition with water in contact with the air. This substance preëxists in the buffy coating.

However important the knowledge of the principle of the buffy coating, which is gradually dissolved in water, may be, that of its insoluble principle is not less interesting. In the present state of our knowledge concerning the combinations of this portion of the blood, we should be *compelled* to regard it as fibrin : the buffy coating would then be a combination of fibrin with the body soluble in boiling water, just alluded to. But the portion insoluble in water is diffrent to fibrin ; it is identical with the substance which is formed by several hours' ebullition of fibrin with water.

However great the probability which these last results give to the existence of these two substances, both different from fibrin, in the buffy coating, one soluble in water by an ebullition of four hours (extracted in great part from the buffy coating, consequently not being *formed by ebullition*, but preëxisting in it), and the other insoluble in water, I do not think, however, to find in it the immediate proof that the latter exists quite formed in the buffy coating. The latter was *submitted to ebullition*, in contact with water, in the air : it should be greatly altered by these influences, in order that the last insoluble portion may possess the foregoing properties. But the analysis of the entire coating gives the proof that the ebullition has no influence ; and the two substances, insoluble and soluble, obtained by an ebullition of four hours, really exist in it before the buffy coating has been submitted to any action whatever ; such as the removal of the fatty matter and albumen of the serum by cold water and alcohol. It is sufficient, at present, here to say, that the buffy coating contains two principles differing from fibrin.

Berzelius (Treatise on Chemistry, vol. ix. p. 51,) indicated, some years ago, that fibrin or albumen is partially dissolved by boiling with water. I repeated these experiments in 1836, extending them a little.

Coagulated fibrin and albumen, boiled with water, and well washed, gave, after 40 hours' boiling :—

	Fibrin.	Albumen.
Portion insoluble in water	79·33	63·08
,, soluble ,,	20·67	36·91

The aqueous solutions were evaporated to dryness, and submitted to ebullition with alcohol ; one portion was dissolved, another portion remained insoluble :—

	Fibrin.	Albumen.
Portion undissolved.....	59·3	66·0
,, dissolved.....	40·7	34·0

From these investigations, accompanied by data concerning the action of certain re-

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* Von Baumhauer has confirmed *de novo* the observation that the fatty matter is one of the causes which make the buffy coating float ; he found in that of a horse :—

Fatty matter removed by ether	3·276
Portion insoluble in ether . .	96·724

agents, I have drawn the following conclusions :—

"There is no property of gelatin, *submitted to ebullition during a great number of hours*, which would not be found in the body insoluble in alcohol; we may, therefore, admit that the ebullition of fibrin and albumen with water gives rise to gelatin."

I repeated the same experiments last year, in the laboratory of the University of Utrecht, in order to determine, by elementary analysis, the composition of fibrin submitted to strong ebullition, and of the aqueous and alcoholic solutions. I expected to find gelatin (boiled during a long time), in the principle of fibrin and albumen, soluble in water; but, since I have studied this latter, and since I have shewn that the salts of lead do not precipitate gelatin which has been boiled for a long time, whilst the other precipitating agents indicate the presence of combinations of protein as well as of gelatin, doubts arose in my mind as to whether the substance of fibrin and albumen soluble in water, is gelatin. This question required a fresh examination. I had never previously thought that gelatin was *a principle* of fibrin or albumen, but I had always regarded it as a product of decomposition, and, consequently, as a new body. Finally, I should also mention, that Gmelin, and Wöhler and Vogel observed—the first a long time ago, and the latter two recently—that albumen and fibrin treated with a small quantity of water, completely dissolves in closed tubes at 302—392°F. The fibrin which I employed was that of the blood of an ox, and the albumen that of eggs: this latter was coagulated and well washed with boiling water. Both were submitted to ebullition; the liquor was decanted; the residue was submitted to ebullition with more water, and so on. The liquors were evaporated to dryness; the product was treated by alcohol, and the alcoholic solution was evaporated. I designate this product by the names *insoluble fibrin* and *albumen*, of the portion dissolved in water or alcohol.

In order that these investigations may be comprehended in their connection with the data furnished by Bouchardat, it must be borne in mind, that if fibrin or albumen arising from inflamed or healthy blood, from the serum of blood or from fowls eggs, be boiled with water, substances soluble in water are always obtained by the first ebullition of four hours, whilst insoluble substances remain in the residue; that it always dissolves fresh quantities of this latter, when the ebullition is repeated every four hours with fresh water; that the remaining insoluble portion becomes poorer in carbon, hydrogen and nitrogen, but richer in oxygen, until at length the apposition is constant; that the portion of albumen or fibrin soluble in water evaporated, exhausted by alcohol, and treated with water, is almost completely soluble in it, and likewise contains less carbon, hydrogen and nitrogen, but more oxygen than protein; that, finally, gives rise, by ebullition, to a body soluble in alcohol, into which it may ultimately be metamorphosed, and which is a mixture of several peculiar extractive substances, which I will examine hereafter. These are products of decomposition, and not higher degrees of oxidation of protein. It is from these substances that the ammonia arises in distillation; it is a product not only of fibrin, as Dumas has observed, but also of white of egg, and of all the matters which contain fibrin, albumen, and probably casein, which exposure to the temperature of boiling water alters, more or less, and all of which give a great quantity of ammonia in the product of distillation.

In order better to study the substances soluble and insoluble in water, it was necessary to boil fibrin and albumen for an unequal length of time, and to collect separately the products of the operations. I say it purposely, because Bouchardat seems to presume that fibrin, and especially the fibrin of inflamed blood, furnishes only substances soluble in water (called by him *gelatin*), which may be completely extracted by an ebullition of four hours. The opinion that these substances pre-exist in fibrin would then be well founded.

Let us first examine the different products which are formed by the ebullition of fibrin of the blood of the ox and white of egg in water. The analyses were made with fibrin which had been boiled from 4 to 26 hours, in Papin's digester, and with albumen, which had been maintained in ebullition in a matrass during 86, 127 and 150 hours.

The analyses of the body extracted from fibrin, which had been boiled during four hours, were made by Von Baumhauer.

Body soluble in water, insoluble in alcohol, extracted from fibrin which had been subjected to ebullition during four hours, and dried at 248°F.

I. 0·3695 gave 0·0115 of ash.*

0·530 or 0·514 of substance free from ash gave 0·9505 of carbonic acid, acid 0·300 of water.

II. 0·221 of a second preparation gave 0·007 of ash.

0·462 or 0·448 of substance free from ash

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* The considerable proportion of ash arises from the glass being partially dissolved by the ebullition.

gave 123 c. c. of nitrogen before the experiment, at 60·8°F. and 750 mm., and 176 c. c. after the experiment, at 50°F. and 755 mm.

0·443 gave 0·802 of carbonic acid, 0·257 of water.

These numbers correspond to :—

	I.	II.
Carbon.....	51·13	51·69
Hydrogen....	6·48	6·64
Nitrogen	,,	15·09
Oxygen	,,	26·58

This body soluble in water may be precipitated by acetate of lead : if the precipitate be separated by filtration, and if the acetic acid liberated be saturated by ammonia, a fresh quantity of the same combination is precipitated ; if this latter be again separated by filtration, and if the liquor be decomposed by sulphuretted hydrogen, there remains in solution a substance which has the same composition : it acquires, by evaporation, the property of being entirely precipitated by acetate of lead.

The fibrin which was not dissolved was again submitted to ebullition during 22 hours ; the water was evaporated, and the residue treated by alcohol. A fresh quantity remained, more considerable than the first time, of a body soluble in water, which had all the properties of the foregoing.

The insoluble residue which the last decoction left gave, after treatment by alcohol and dessiccation at 248°F., the following results :—

0·290 gave 0·003 of ash.

0·398 gave 0·765 of carbonic acid, and 0·245 of water.

0·532 gave 115 c. c. of nitrogen before the experiment, at 51·2°F. and 764 mm., and 185 c. c. at 53·4°F. and 755·4 mm. after the experiment.

Carbon	53·69
Hydrogen	6·90
Nitrogen	15·63
Oxygen.....	23·71

Fibrin boiled with water for a few days, in Papin's digester, but treated as above, furnished the following result :—

0·194 *of the part soluble in water, insoluble in alcohol*, gave 0·010 of ash.

0·606 gave 1·078 of carbonic acid, and 0·351 of water.

0·297 gave 0·006 of ash.

0·515 gave 125 c. c. of nitrogen at 53·6°F. and 750 mm. before the experiment, and 191 c. c. at 244·2°F. and 753 mm. after the experiment.

These numbers correspond to :—

Carbon	51·84
Hydrogen	6·78
Nitrogen	15·67
Oxygen.....	25·71

Portion insoluble in water and in alcohol :

0·540 gave 0·050 of ash.*

0·412 gave 0·727 of carbonic acid, and 0·227 of water.

0·523 gave 112 c. c. of nitrogen at 50°F. and 768 mm. before the experiment, and 179 c. c. after the experiment.

Carbon	58·72
Hydrogen	6·73
Nitrogen	14·82
Oxygen.....	24·73

ALBUMEN OF WHITE OF EGG, SUBMITTED TO EBULLITION DURING 150 HOURS, AND TREATED AS ABOVE.

Portions soluble in water, insoluble in alcohol.—Its aqueous solution was precipitated by acetate of lead ; the precipitate was washed, decomposed by sulphuretted hydrogen, and the liquor was evaporated.

I. 0·180 gave 0·005 of ash.

0·404 gave 0·734 carbonic acid and 0·240 of water.

The liquor, separated by filtration from the precipitate produced by the neutral acetate of lead, was saturated by ammonia ; the precipitate formed was washed on a filter, the decomposed by sulphuretted hydrogen, and the liquor was evaporated.

II. 0·156 gave 0·003 of ash.

0·280 gave 0·517 of carbonic acid, and 0·163 of water.

0·215 of another preparation gave 0·013 of ash.

0·695 gave 126·5 c. c. of nitrogen at 53·4°F., and 771·8 mm. before the experiment, and 170·5 c. c. at 62·6°F. at 772·7 mm. after the experiment. These numbers correspond to :—

	I.	II.
Carbon	51·38	51·99
Hydrogen	6·78	6·60
Nitrogen	15·01	,,
Oxygen	26·82	,,

The organic matter in these salts of lead has, therefore, exactly the same composition as that of fibrin of the buffy coating, after an ebullition of four hours, and of fibrin in Papin's digester.

GENERAL CONSIDERATIONS AND INDUCTIONS RELATIVE TO THE MATTER OF LIVING BEINGS.†

BY M. E. CHEVREUL.‡

I MAY observe that there are two very different modes of studying and explaining the

* This great quantity of ash is due to sulphuret of tin, arising from the tinning of the digester.

† *Journal de Pharmacie*, January, 1844.

‡ At a time when the most distinguished chemists are publishing works of considerable interest concerning nutrition and assimilation,

phenomena of life. In the one, they are made to depend, *mediately* and *immediately*, on a peculiar force called the *vital principle*, which is often represented as the antagonist of the forces which govern the crude matter, such as weight, affinity, heat, and magnetism. In the other, without prejudice concerning the nature of the forces which produce the phenomena, it is sought, after having defined these latter as well as possible, to trace them to their *immediate* or proximate causes; and, although far from admitting, *à priori*, that they are the immediate principle, we are inclined, on the contrary, to refer them to the forces which govern the crude matter. It is to this latter mode of regarding the phenomena of life that I have given the preference in my work on *Organic Analysis and its Applications.**

The work which I have just mentioned is only the development and the demonstration of two general propositions: *the first* is, that the basis of organic chemistry is the precise definition of the species of immediate principles which constitute plants and animals; and, by precise definition, I mean that which rests on the elementary composition, and on the physical, chemical, and organoleptic properties of each species in particular. *The second proposition* is, that it is impossible to make, with success, any rather general application of chemistry to the study of the phenomena of living beings, while we have not defined the species of immediate principles which constitute the tissue and fluids, seats of the phenomena which we wish to study. Indeed, all these phenomena being referred, finally, to immediate principles, so long as these are not defined into distinct species, the study of the phenomena which are referred to them, when they form part of the living being, will be as vague as is their determination. If, on the contrary, they have been studied in their composition and in their properties, and if hence they be defined into distinct species, perhaps it will be capable of explaining in the living being, which these species of principles constitute, a phenomena which was heretofore referred to what is called the *vital force*. The following supposition will render my idea comprehensible.

Let us suppose that an organised being contains Prussian blue in a liquid, performing the functions of sap or blood, and that this liquid penetrates into an organ which receives an action of light capable of reducing this coloring principle into cyanogen and protocyanide: let us suppose that there be an exhalation of cyanogen, then an absorption of oxygen, and that, this oxygen being carried with the protocyanide into the organs on which light does not act, there is a formation of Prussian blue and peroxide of iron: I now say that the exhalation of cyanogen, and the decoloration of the liquid containing Prussian blue in the organ which would be struck by light, and the recoloration of the liquid, followed by an absorption of the oxygen, and its subtraction under the solar influence, would be phenomena which one ignorant of the properties we have remarked in Prussian blue would refer to a vital force; whilst he who is acquainted with them, meeting with this coloring matter in the liquid of a living being, and observing the phenomena which I have mentioned, would very soon have explained the decoloration and recoloration of the liquid without recurring to a vital force.

Moreover, if we suppose that an organ isolates the peroxide of iron from the regenerated Prussian blue, in proportion as the recoloration of the liquid takes place, there will be secretion, and if this peroxide accumulates in an organ, he who knows the properties of Prussian blue will explain the origin of the peroxide of iron. Finally, if it were true, as some naturalists have admitted, that the secretions were operated in consequence of an electrical state of the organs, the very act by which the peroxide of iron would be separated from the liquid performing the function of sap or blood, in order to increase or nourish an organ, would also be explained without recurring to a vital force.

In order to complete these ideas concerning the utility of chemistry applied to the knowledge of living beings, I will also add some considerations relative to the assimilation of the matter which they take from aliments. There is an intimate relation between the chemical composition of an aliment and that of the being which is nourished by it; but, to appreciate this relation, two cases must be distinguished:—

I. The case in which the living being derives its nourishment from a matter contained in a seed or an egg, according as this being is a plant or an animal.

II. That in which the living being grows principally at the expense of external bodies, as does a plant provided with green organs, or an animal in the adult state.

FIRST CASE.

Between the germination and the development of the germ and of the egg, there is this relation, that a certain temperature and the contact of atmospheric oxygen are indispensable; and this difference, that most seeds

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we have thought fit to reproduce this very important and little-known memoir of Chevreul, on the same subject.

* *Considérations générales sur l'Analyse Organique et ses Application.* (Levrault: Paris, 1824.)

germinate only by taking water from without; whilst eggs, at least those of birds, contain a greater quantity of this liquid than is necessary for the development of the germ; indeed, according to my experiments, they lose about one-fifth of it, on the average, during incubation. The young vegetable finds, therefore, in the seed, as the young animal in the egg, all that is necessary for its development, except temperature, atmospheric gas, and for germination, the water, which come from without.

The nature of the immediate principles contained in the grain and the egg perfectly account for the part which they act as matter proper for the development of the germ. Indeed, the seed presents the principle types of the matters which will be found in the developed germ. Thus it presents various species of immediate principles of a fatty nature; various species of neutral non-nitrogenous ternary principles, such as starch, amidin, one or several species of quarternary nitrogenous principles, such as gluten, vegetable albumen, salts which appear to me essential to vegetation, &c.

The egg contains immediate nitrogenous principles, albumen among others, which is one of the principal bases of animals, several fatty principles, such as steärin, oleïn; several coloring principles, one of which is especially remarkable, as it appears to me disposed to form the hæmatosin of the blood; several inorganic bodies, such as soda, which I regard as essential to the constitution of the blood; the chlorides of potassium and sodium, which are met with in all the animal fluids; the phosphates of lime and magnesia, bases of the bones; finally, sulphur, which we meet with in plants, exists in albumen: such at least is the composition of the eggs of birds.

If, passing from the ovipora, to the mammalia, we view the young animal with relation to the milk which nourishes it, we remark that the immediate principles which constitute this liquid are very numerous, and that they represent very varied types of composition. In this double respect they are, therefore, eminently adapted for assimilation by the numerous systems of organs which it is their province to nourish. Indeed, we find in milk the inorganic base of the bones, the phosphates of lime and magnesia; a non-nitrogenous acid, the lactic, analogous to the ternary acids of vegetables; an immediate ternary principle, sugar of milk, analogous to the gums and to the sugars of vegetables; neutral fatty bodies, such as margarine, oleïn, butyrin, caprin and caproïn, types of fatty bodies, several of which are met with in the animal, not only while it is young, but also in all periods of its life; finally, caseïn, a type of the quaternary nitrogenous principle, which has the greatest analogy to albumen and even to fibrin. We may add, that the alkaline chlorides and salts which have not been named, also form part of milk as well as of animals.

SECOND CASE.

If we consider the developed vegetables provided with green parts, and the mammalia suckled by their mothers, we perceive a great difference in their respective faculties of assimilating the matters of the external world.

Vegetables, less complicated in their organisations than animals, can assimilate water and gases—the carbonic, for example; if they do not assimilate this compound integrally, they assimilate it partially, as is the case when there is in their green organs, under the influence of light, a fixation of carbon, and an exhalation of oxygen. On the other hand, the manures necessary for making them acquire a maximum of development generally present organic matters more or less altered at the time when they penetrate into their interior.

Such is the relation of the aliments to the vegetable in the normal state; but, when the manure is employed in excess, with the intention of modifying the normal organic arrangements of a plant, I would not dare to affirm that there are not cases in which aliments less altered than those of which I have spoken, and consequently more nearly approaching to the immediate principles of the vegetables which they should nourish, may be susceptible of assimilation. If such a fact were demonstrated, for example, with respect to blood, which is a powerful manure, far from being contrary to what I have said concerning vegetable aliment, it would be an exceptional case, which would tend to confirm the general case.

Finally, the assimilation of aliments exhausted externally, would be operated in plants only under external influences of light and temperature; so that, beyond these circumstances, the functions of these beings remain suspended, as we find when they are exposed to the cold of our winter, or are plunged in a glacier.

If from plants we pass to animals, we perceive that the more the organisation of the latter is complicated, the aliments with which they are fed are complex and analogous in chemical composition to the organs which they should sustain. My reasoning relative to milk, considered as the aliment of young mammalia, is also applicable to the cases of the alimentation of adult mammalia, since every one knows that milk is for man, at every age, an excellent aliment.

The analogies which we recognise between

the immediate prineiples of animals and the aliments which nourish them, exist not only between the carnivora and the flesh of animals which nourish them, but also between the herbivora and their aliments. And, in here calling to mind the complex composition of seeds, of which I have above spoken, in order now to remark how proper it is to the alimentation of the herbivora, granivora and omnivora, is a new fact to be added to the foregoing. Finally, the herbivora, which are exclusively nourished with herbs, find in these latter very varied immediate prineiples, analogous to those which constitute the matter of their organs. But it must be remarked, that in flesh, the aliment of the carnivora, almost all the immediate prineiples which constitute it are nitrogenous; whilst in the herb, the aliment of the herbivora, the immediate nitrogenous prineiples are present in it only in very small proportion in comparison with the non-nitrogenous ternary immediate prineiples. It is to this difference of immediate composition that must be attributed the reason why, *ceteris paribus*, a greater mass of aliments is required for the herbivora than for the carnivora; and why, in the former the digestive apparatus generally presents a greater surface to the alimentary mass than in the carnivora, and why, digestion requires more preparation and time for its accomplishment.

Finally, it must be remarked, that the assimilation, in the superior animals at least, is more independent of the external circumstances of light and temperature than in vegetables.

It is evident that green vegetables are nourished with water, carbonic acid gas, and organic matters in the state of manure, or, in other terms, generally very much altered; whilst animals, at least those of the highest organisation, require matters much more complex in their composition, and more varied in their properties.

(*To be concluded in our next.*)

ON SOME NEW LACTATES.*

BY PROFESSOR LEPAGE.

Since the year 1841, I have devoted myself to the preparation of lactic acid on the large scale, and consequently of lactate of iron, a salt introduced into therapeutics, a few years ago, by Professor Bouillaud.

I will not here recapitulate the process of extracting lactic acid, but will only observe, that for its preparation I employ whey, which is found in abundance, and free from water, in our neighbourhood (Gisors) throughout the summer, a ta very low price, and that, on the average, I obtain from 30 litres of this product (without addition of lactine)—following, for its saturation, the directions given by MM. Boutron-Charlard and Frémy—400 grammes of pure lactate of lime.

Lactic acid is now so well characterised that it can no longer be confounded with any other; nevertheless, its history cannot be regarded as complete. Feeling persuaded, therefore, that everything relating to the history of this acid, or to that of its combinations, must be interesting to chemists, I now publish the results of some experiments which I have tried with the view of obtaining various lactates not yet known.

I. LACTATE OF OXIDE OF ETHULE (LACTIC ETHER).

By distilling in a retort, furnished with an adopter and a receiver, a mixture of two parts of powdered and dried lactate of lime, two parts and a half of rectified alcohol, and one part and a half of sulphuric acid at 66°, taking care to stop the operation when the matter in the retort begins to turn brown, a liquid is obtained in the receiver, which, put in contact with fused and pulverised chloride of calcium, decanted after 24 hours' contact, and submitted to a second distillation, possesses the following properties:—

It is transparent, colorless, possessed of an odor somewhat resembling rum; its density is about 0·866 at 48° F., it boils at 170° F., under the pressure of 28½ inches; it is neutral to test papers, miscible with water, alcohol, and ether, in all proportions. A small quantity of this same liquid, left for a month in a flask filled with air, remained neutral to test papers.

The caustic alkalis decompose it into alcohol and lactic acid, which unites with the alkali: this phenomenon is especially apparent with lime. It is sufficient, indeed, to agitate this liquid with a little hydrate of lime in a sealed flask for all to assume the form, the same day or the day after, of a white mass having the appearance of gelatinous alumine or silica. This mass easily liquifies in the sand-bath, and the liquified product, filtered and suitably evaporated, gives, on cooling, a crystallized salt, which possesses all the properties of lactate of lime.

From these facts I think I may conclude that I have obtained lactic ether.

In the preparation of this product, all the lactic acid of the lactate of lime, liberated by

* *Journal de Chimie Medicale*, Jan. 1844.

sulphuric acid, does not enter into combination with the oxide of ethule; for, by diluting the residue remaining in the retort, filtering, in order to separate the sulphate of lime, and saturating by chalk, sulphate of lime is obtained, and is precipitated; there is found in the liquor a small quantity of lactate of lime, which is easily removed from it by evaporation.

II. LACTATE OF OXIDE OF METHULE.

By substituting pyroxilic spirit for alcohol in the foregoing preparation, I hoped to obtain lactate of the oxide of methule, but my expectations were deceived, for I could not detect in the product which I obtained any other products than those which belong to pyroxilic spirit: thus, for example, the liquid put in contact with hydrated lime does not assume the form of a jelly, as in the foregoing case; nevertheless, if it be filtered, the presence of a small quantity of lime may be detected in it; but it is impossible to obtain the crystallized salt by the evaporation of the liquid. When the experiment was repeated with pure pyroxilic spirit, absolutely the same results were obtained. Now, since pyroxilic spirit possesses the property of dissolving certain alkaline oxides, as was proved, a long time ago, by Dumas, and, among others, oxide of calcium, it must be admitted that the small quantity of this alkali found in the product which I examined, arose from the known property of lime dissolving in pyroxilic spirit.

Another fact also tends to confirm my statement, that by saturating with chalk the residue removed from the retort, and previously diffused in a sufficient quantity of water, I was able to extract from it a quantity of lactate of lime nearly equal to that which I had employed.

Notwithstanding this negative result, it is probable that, in more favorable circumstances, lactate of oxide of methule might be obtained.

III. LACTATE OF CADMIUM.

To obtain this salt, two processes may be put in practice:—

First Process.—The lactic acid is saturated by hydrate or carbonate of cadmium, recently precipitated. The operation is accelerated by holding the phial in which the operation is conducted in water heated to from 158° to 176° F. When the liquid dissolves no more oxide, it is filtered, then evaporated at a very gentle heat until white pellicles are seen to float on the liquid. The capsule is then removed from the fire, and, on cooling, the salt is deposited in a spongy mass formed by the re-union of all the small needles. The small quantity of supernatant liquor is decanted; this liquor may give more salt by concentration; the product obtained is afterwards dried by heat, or in folds of blotting-paper.

Second Process.—A concentrated solution of sulphate of cadmium is afterwards decomposed by a concentrated solution of lactate of lime. The proportions to be employed are about 20 parts of lactate of lime to 15 parts of crystallised sulphate of cadmium. It must be operated with ebullition, for without heat the precipitation of the lactate of lime would take place very imperfectly, and would often require a long space of time. When it is ascertained that the liquor no longer contains either sulphate of cadmium or lactate of lime, it is filtered, and then evaporated, as in the foregoing case.

The lactate of cadmium obtained by each of these processes is a white salt, crystallised in very small needles. It is soluble in from 8 to 9 parts of cold water, and in four parts of boiling water; it is insoluble in alcohol; its aqueous solution acts with reagents like that of all the soluble salts of cadmium.

This salt presents, in its crystallization, a peculiarity, which is not, however, an isolated fact in chemistry—namely, that its solution saturated by ebullition does not crystallize by the cooling of the liquor, even after eight days (this, at least, is the phenomenon which two saturated solutions of this salt have presented to me). To crystallize it, it must be again submitted to the action of heat; and if, as soon as some pellicles appear on the surface of the liquid, even before it enters into ebullition, the capsule be removed from the fire, the whole takes the form of a mass on cooling.

It is ascertained that lactate of cadmium prepared by the second process does not contain sulphate of cadmium in the mixture, by its very dilute aqueous solution not being rendered turbid by chloride of barium. But, in order to ascertain that it contains no lactate of lime, oxalic acid must not be added to its solution, as this acid causes in the soluble salts of cadmium an insoluble white precipitate of the same base. It should be operated in the following manner:—All the cadmium should be precipitated from the solution to be tested in the state of yellow sulphuret, by means of sulphuretted hydrogen; oxalic acid is thus added after the liquor has been filtered, and previously heated, in order to drive off the excess of sulphuretted hydrogen.

IV. LACTATE OF PROTOXIDE OF ANTIMONY.

I endeavored to dissolve in lactic acid oxide of antimony precipitated from emetic by the process of M. Durand, of Caen, or oxide precipitated from the same salt by ammonia, but without heat, and in both cases

the acid dissolved only very minute quantities of oxide, incapable of saturating it. I think that protoxide of antimony, which, as is known, is endowed with almost as eminently electro-negative as basic properties, is, in general, little susceptible of combining alone with the vegetable acids: however, Berzelius describes several antimonial salts of organic acids. Having wished to prepare acetate of antimony with the same oxide as that which I used for the lactate, this oxide refused to dissolve with or without heat in acetic acid, even when very concentrated.

ON THE COMPOSITION OF OIL OF HORSE-RADISH (OLEUM ARMORACEÆ).*

BY C. HUBATKA.

The natural sulphurous substances, with the exception of the combinations of proteïn, have hitherto been little studied. These are, for the most part, volatile oils of the families of *Liliaceæ* and *Cruciferæ*. The only one which has been carefully studied, mustard oil, furnished extremely remarkable results by the investigations of Varrentrapp and Will.

The attentive study of other sulphurous oils would therefore be interesting.

Mustard oil does not pre-exist in the seeds; it is formed, as is known, only in the seeds bruised in contact with water in a manner analogous to the production of oil of bitter almonds by amygdalin. The oil is, on the contrary, ready formed in the root of horse-radish; for, if it be cut or bruised, its odor, which it is impossible to mistake, is immediately developed. The root also contains sufficient water, without fatty oil, if it primitively contained substances similar to those of mustard seed, for the decomposition which takes place in the latter to be operated of itself in the root.

Some horse-radish, from the neighborhood of Malin, in Bohemia, where enormous quantities are annually produced, was distilled, in large glass retorts, according to the following process:—

It is cut in small pieces and put, with two-thirds of its weight of water, into the retort, the latter being placed in a sand-bath; it is put in communication with a Woulfe's apparatus, and the distillation is proceeded with, taking care to cool well. The oil obtained, which is of a light yellow color, is found at the bottom of the receivers. The water of the first distillation is employed instead of pure water in the succeeding distillations.

One hundred pounds (French) of horse-radish give about 5-7 drachms of impure oil. It is rectified by distilling, *de novo*, with about four parts of water, and placing it over chloride of calcium in order to obtain it perfectly pure.

The oil thus obtained is perfectly colorless, or, at the most, of a pale yellow color; by time the color becomes deeper. Its specific gravity is 11·01. Its odor is penetrating, and provokes tears: it is impossible to distinguish it from that of mustard oil. One drop, applied to the skin, occasions considerable smarting, and occasions blisters like mustard oil. It is very soluble in alcohol and ether, and sparingly soluble in water. Gaseous chlorine converts it (giving rise to hydrochloric acid and chloride of sulphur) into a thick mass, of a deep color, which melts at 212°F. Treated by alcohol, it leaves a viscid body possessing the odor of fused sulphur.

Concentrated nitric acid exerts a very powerful action on this oil, disengaging deutoxide of nitrogen, with a separation of a porous mass of a sulphur-yellow color (nitro-sinapilic resin). The slow action of nitric acid completely destroys the oil and converts the sulphur into sulphuric acid. It is quite as difficult as with mustard oil to completely convert the sulphur into sulphuric acid.

Hydrated sulphuric acid also has a powerful reaction on oil of horse-radish; sulphurous acid is disengaged.

It gives, with ammonia, in the same conditions as mustard oil, a compound crystallised in the same manner.

By digestion with recently precipitated oxide of lead and evaporation to dryness in the sand-bath, sulphuret of lead and a body similar to sinapolin are obtained. The odor of oil of horse-radish, its specific gravity and its reactions, are so identical with those of mustard oil, that analysis could only confirm this identity.

0·3328 grammes of oil of horse-radish gave 0·5858 of carbonic acid, and 0·1575 of water.

These numbers exactly correspond with the composition of mustard oil:—

			In 100 parts.	
			Calculated.	Found.
Carbon. . .	8 atoms	606·83	48·60	48·41
Hydrogen	10 ,,	62·40	5·00	5·26
Nitrogen..	2 ,,	177·04	14·18	
Sulphur..	2 ,,	402·33	32·22	
Mustard oil	1 ,,	1248·60	100·00	

The ammoniacal compound was white, of fine crystallization, soluble in alcohol, ether, and water, inodorous, of a bitter taste, fusible by heat, crystallizing on cooling. With deutoxide of mercury and hydrated oxide of lead,

*Annalen der Chemie und Pharmacie.

metallic sulphurets are produced; the liquor contains a body resembling cinnamon. Chloride of mercury and nitrate of silver form in the aqueous solution voluminous white precipitates: the latter is quickly blackened, sulphuret of silver being separated.

This compound is formed of:—

	Atoms.	Calculated.	In 100 parts. Found.		
Carbon.....	8	606·83	41·48	41·00	41·03	,,
Hydrogen..	16	99·81	6·82	7·07	6·92	,,
Nitrogen...	4	354·08	24·20	,,	,,	23·86
Sulphur....	2	402·33	27·50	,,	,,	,,
Compound of oil of horse-radish and ammonia...	1	1463·08	100	,,	,,	,,

The composition of the ammoniacal compound of oil of horse-radish is, therefore, identical with that of the same compound of mustard oil. These two oils are consequently one and the same body.

ON THE PREPARATION OF PURE GOLD, AND REMARKS ON THE ASSAYS OF GOLD.*

BY M. A. LEVOL.

It is known that nothing is more difficult than to obtain the metals in a state of, I will not say absolute purity, but relative to the means of proof which are at the disposal of chemists. Among these substances, silver and gold have always been regarded as the least difficult to be obtained in this state; and by the names of cupel silver and gold *cornet* it was formerly pretended to designate silver and gold of the highest possible degree of purity. Cupel silver is now no longer thought of, but we have perhaps remained in the error relative to the gold of the *cornets* of assay; these *cornets*, indeed, always retain traces of silver, which, however, are very slight; and in this respect it would be right to set great value on it, as compared with the gold of merchants, for pure gold is a product unknown in commerce, and that which is sold as such contains two or three thousandths of impurity.

PURIFICATION OF GOLD BY THE PROCESSES OF DEPURATION.

That which I have said above respecting the impurity of assay-*cornets* is sufficient to show that depuration, as it is ordinarily performed, namely, by nitric acid, is not to be recommended for the preparation of pure gold, and as much may be said of the depuration by means of sulphuric acid. The fine gold of commerce furnishes a proof of this assertion, since it results from the refining of gold by this acid on the large scale.

PROCESSES OF REDUCING CHLORIDE OF GOLD.

By Sulphate of Protoxide of Iron.—This process, recommended by same authors, is very imperfect, because the chloride of silver furnished by gold which is refined, remains partly with the gold dissolved in aqua regia, even after the experiment, and is found revived the same as it is by the salt of the protoxide of iron.

By Oxalic Acid.—This means is thoroughly good, and furnishes very pure gold; but it has some inconveniences which I recapitulate here; great length of time, especially if the salt of gold be with an excess of acid, projections of the liquor by the disengagement of carbonic acid, and the necessity of employing very large vessels on account of the feeble solubility of oxalic acid.

By the Solution of Arsenious Acid in Hydrochloric Acid.—Some years ago I announced the fact (*Annales de Chimie et de Physique*, 3rd Series, t. i. p. 501), that the protochloride of arsenic possesses the property of reducing the chloride of gold; but I added that this reduction is too slow to be applied to the determination and estimation of mixtures of chloride of arsenic; I have since seen that, by rendering the liquors neutral, or slightly alkaline, the re-action is sufficiently accelerated to be advantageous in analysis, and also in the purification of gold; but the dangers presented by the use of a reagent so poisonous as arsenious acid, and especially as it is employed in solution, make me hesitate to recommend this process for large operations.

By Protochloride of Antimony.—The fact of the reduction of the chloride of gold by this salt was announced at the same time as the foregoing, and it is at this means that I have finally stopped, operating as follows:—Gold of commerce is dissolved in aqua regia formed of four parts of ordinary hydrochloric acid, and one part of nitric acid at abont 20°B. It is filtered to separate the residue of chloride of silver, and we add to the liquor protochloride of antimony, to which hydrochloric acid is added in sufficient quantity to prevent the water holding in solution the chloride of gold from becoming turbid; if this happens, and if a white precipitate appear, it may easily be re-dissolved by means of hydrochloric acid, and that without any inconvenience. The calculation of equivalents indicates and experience confirms, that 177 of protochloride of antimony reduce exactly 100 of gold from its perchloride. But, in practice, it is convenient to raise the

* *Revue Scientifique.*

proportion to 200, or to double the weight of the gold, inasmuch as the excess can cause no injury. The reduction is complete at the end of a few hours, especially if it be slightly heated: the gold is thrown on a filter, it is washed first with weak hydrochloric acid, then with water, and it is fused in an earthen crucible with a small quantity of saltpetre and borax.*

This gold constantly gives a surcharge in the assay, even when we observe the modification made in the ordinary process by Zillet, and regulated by Chaudet; but by applying the process of M. D'Arcet, for the analysis of the alloys of silver and platinum, that is to say, by using only sulphuric acid for the depuration, we constantly find 1000|000, if the ebullition has been well sustained during the required time. Sulphuric acid has, therefore, a real advantage over nitric acid for depuration; but I should here remark that this by no means proves that by means of sulphuric acid, it is possible to obtain pure gold, since it is well known that lead carries gold into the cupels, and, moreover, the temperature remaining the same, as the dose is raised, so that below the strength of 7000|1000, by the process generally adopted for assaying gold, loss is experienced, because then this dose is found very considerably augmented. It is, therefore, evident that precision in the assays of gold depends on a certain temperature, which is established of itself in a more or less exact manner, according to the circumstances of the operation; since, on one hand, experiment proves that the cupels always absorb a small portion of gold of the assay submitted to cupellation; and that, on the other hand, the *cornet* of gold, after the depuration, constantly retains traces of silver. Now, it results from this, that, for low strength, the quantities of lead necessary for eliminating the copper, increasing more and more, to a certain limit, finally lose more of the gold assayed during the cupellation than the depuration leaves of silver, which depreciates the final result; and as the opposite of this happens with high strengths, which require very little lead, that produces surcharges which increase the strength of the gold in an opposite direction. But these differences are always very much restrained in well-directed operations; that is to say, made in the most favorable circumstances, by an experienced assayer.

* The filtered liquors, which are then composed of perchloride of antimony, may be returned to their primitive state, and thus serve indefinitely for this operation, if they be boiled over metallic antimony after they have served.

ON THE PRESENCE OF FORMIC ACID IN THE BRANCHES OF PINASTER IN PUTREFACTION.*

BY REDTENBACHER.

The acid reaction of the oil of turpentine of commerce arises from the formic acid which is formed by its oxidation. Weppen obtained formic acid with oil of turpentine by means of oxidising agents, and has thus given the explanation. The following fact may serve to confirm this mode of producing this acid in oil of turpentine.

A proprietor of Bohemia used as litter some branches of pinaster, and, after having employed it in this way, he piled it in a heap. It remained for some months heaped up in the open air. A short time ago, it was required to remove it to be used as manure, and then a strong odor of ants was given off from the interior, without any traces of these animals being discoverable. The interior part strongly reddened litmus paper. Mixed with water, it gave by filtration a yellowish brown liquor of a decidedly acid taste, and possessing a powerful acid reaction. This liquor was distilled alone: the acid product of the distillation was saturated by carbonate of soda, and evaporated. It was then easy to demonstrate the presence of formic acid, with all its properties. The addition of sulphuric acid developed a manifest odor of formic acid; the neutral salts of peroxide of iron gave rise to a blood-red coloration; nitrate of silver and protonitrate of mercury were easily reduced to the metallic state.

The considerable quantity of formic acid in these branches of pinaster in a state of putrefaction, can be attributed only to the oil of turpentine which it contains, and which furnished the formic acid by oxidation in the course of the putrefaction.

PREPARATION OF PURE NITROGEN.†

BY M. MARCHAND, OF FÉCAMP.

M. Marchand prepares nitrogen, not by the action of chlorine on ammonia, nor by the disorganisation of the air by phosphorus, but by the reaction of the decoloring chlorites on liquid ammonia. For that purpose, he puts into a matrass a solution of oxichloride (*chloroxure*) of calcium, and adds to it liquid ammonia: a vivid effervescence ensues; and if, by means of a bent tube, the disengaged gas be directed into a bell-glass, considerable quantities of pure nitrogen are obtained.

* *Annalen der Chemie und Pharmacie.*
† *Journal de Pharmacie*, Jan. 1844.

ON A CHARACTER OF STRYCHNIA.

BY M. MARCHAND, OF FÉCAMP.*

STRYCHNIA, as a poison, occupies a prominent position among organic alkalis. A clear and precise reaction, capable, in medico-legal cases, of detecting with certainty very minute quantities of it, has long been wanting. M. Marchand thinks he has solved the problem. When a very small quantity of strychnia is triturated with a few drops of concentrated sulphuric acid, containing one-hundredth of its weight of nitric acid, the strychnia disappears; but, if a little peroxide of lead be added, a fine blue color immediately appears, which rapidly passes to violet, then gradually to red, and, finally, after a few hours, becomes yellow.

Hitherto, no substance has presented this reaction.

M. Marchand states that, by means of this process, 0·gr. 00005 of strychnia in solution may be detected.

ON THE DIFFUSION OF GASES.

BY WILLIAM ONION.

IT has for some time been a matter of inquiry as to whether the gases constituting atmospheric air, are merely mechanically mixed, or combined by chemical affinity. The arguments advanced against their mechanical mixture were, that one gas being specifically lighter than the other, they ought to separate, the heavier gas being found near the surface of the earth, and the lighter one only at immense heights; that such is not the case is well known. The latest experiments, by MM. Dumas and Boussingault (Chemist, No. XX.) "make it to be presumed that the air is an uniform mixture at every time, in every latitude, and at *every height*." Dr. Dalton proposed an hypothesis to obviate this difficulty; but this is likewise open to many objections: Donavan has likewise offered some remarks on this subject. I shall mention them, making such remarks as I consider necessary, and shall afterwards offer another method of accounting for the fact.

Dr. Dalton proposed to consider that the repulsion which exists in the atmosphere is between nitrogen and nitrogen, and oxygen and oxygen, and not between nitrogen and and oxygen; they would thus expand and contract, regardless of each other; and each gas would sustain the pressure of its own particles, but not that of the other. In support of this opinion he made the following experiment:—Having placed a phial containing carbonic acid underneath a phial containing air, and having connected the two by a glass tube 30 inches long, and one-third inch in internal diameter, at the expiration of an *hour*, the *common air phial* had acquired *no sensible quantity* of carbonic acid, but at the expiration of *three* hours, it had it in *great quantity*; thus the carbonic acid must have been displaced by a gas much lighter, and *vice versâ*; he obtained the same results with other gases. Graham has since ascertained that each gas has a diffusive power of its own, which is inversely proportional to the square root of its density; he has drawn up tables representing their diffusive power, taking air as a standard.

The objection has been advanced against the theory of Dalton, that if one gas acts as a vacuum to another, there ought to be an instant commixture in the above experiment. He answers this by saying that the gases meet with mechanical obstruction, owing to their minute division while passing each other. Donavan says, on this subject, when advocating the chemical principle, "is it conceivable that such an obstruction could exist in the transmission of two gases through a tube one-third of an inch diameter, and that for the space of an hour, there should not have passed, *even* the *smallest* quantity of carbonic acid into a vacuum? We shall again revert to this argument."

On the chemical side it is argued that atmospheric air is a chemical compound composed in 100 parts of 20 oxygen and 80 nitrogen: or,

1 atom oxygen =		8
2 ,, nitrogen	14 × 2 =	28
		36;

or in volume of,

oxygen 1
nitrogen 4 combined without condensation.

To this opinion, which is supported by Thomson, Prout, &c., it is urged that since neither condensation nor change of properties is observed, they cannot be chemically combined. It is well known that many changes take place where there is a decided change of properties, and yet no condensation; the hydracids, dentoxide of nitrogen, carbonic oxide, &c., are well known examples, so that chemical combination can take place without condensation in gaseous fluids. To the other, I reply, that the combination which takes place on mixing concentrated sulphuric acid with water is of the same kind, for here no change of properties is observed. The solution of salts in water is another instance, so that chemical combination can take place without a *total* change of properties. Donavan advances the following as a similar

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* *Journal de Chimie Médicale*, Jan. 1844.

instance, viz., the absorption of gases by charcoal; and says, why may not gases act in the same manner, without entering into an energetic combination, and yet without separating by difference of specific gravity? My answer to this is, that charcoal absorbs gases by reason of its presenting a vacuum in its pores, and not on account of any affinity; for if presented to another gas after being saturated (if I may so speak) with a former one, it will give out a portion of the first gas and absorb part of the last. This appears in great measure to depend on the specific gravity of the gases, for Vogel has proved that it will absorb a greater portion of oxygen than nitrogen. The experiments of Theodore de Saussure seem to establish the opinion that for equal bulks of charcoal it absorbs a greater quantity of those gases which were heaviest, and less of hydrogen than of any other gas. This seems to prove that it is not owing to any attraction the gases have for charcoal; so this analogy will not hold good. Another argument advanced by him is, that "the obstacle to the question of their affinity is the elastic form, but a *partially* successful exertion may be conceived to operate so far, that the *solid* elements would be retained at the limits between *calorific repulsion* and *chemical affinity*, the *latter force* being active in a slight degree, but not sufficiently so to effect a combination." I cannot myself conceive how two bodies can remain in the state he says, much more be subjected to such changes as our atmosphere, which changes are (supposing affinity to have the predominance) more likely to effect a combination than a decomposing influence, the air, as is well known, being a very unstable compound.

Donavan advances many more arguments against the hypothesis of Dalton, and then advances the following remarks:—

"I think we are under the necessity of seeking the explanation of the mixture of the gases on a *gratuitous* principle, which supposes the caloric that is in, or surrounds two particles of different kinds of matter in the gaseous state to obey a law *diametrically the reverse* of what we know would act upon them if they were in the liquid or solid state." This argument is not supported by analogy, reason, or experiment; and is far worse than Dalton's, with all its faults; for here we are under the necessity of supposing a law contrary to what exists with relation to other kinds of matter; and why a body in the state of vapor should obey laws contrary to what it would if in the solid or liquid state, I cannot conceive.

Chemical affinity must be considered as a *general* property of matter; it may, for all we know, depend upon the *electrical* state of bodies, or it may in some unknown way be allied to *gravitation*. The word affinity is used here merely in a general sense, to express a chemical combination between two or more substances, *without regard* to the manner in which it is *effected*, or the properties of the combination; and also that chemical affinity may be in operation, and hold bodies together by its power, where there is *not a chemical combination in fixed and invariable proportions*. Upon these grounds, then, I advance the following analogical reasoning to explain why different gases have the power of diffusing themselves through each other. It appears to me the most likely, and the plainest method of accounting for the constitution of the atmosphere, and the changes to which it is subjected. The latest experiments to ascertain the composition of the atmosphere, and which seem to have been made with the greatest accuracy (See The Chemist, No. XX, August, 1841), tend to prove that it is composed, by volume, of 20·81 oxygen, and 79·19 nitrogen, which differs from the composition stated in the former part of this paper; and many chemists will not now allow that it is differently constituted; but I shall adopt the former opinion, as being the most consistent with established laws, and which will be supported by the following reasoning:—

We cannot reason that they are held together by different electrical states, for it has not been determined whether nitrogen is an ion or not. If we consider, with Berzelius and others, that nitrogen is an oxide of a metal enormously volatile, may not this stable oxide combine with a further portion of oxygen, and form an unstable compound which is decomposed by the slightest causes, reverting to its former state? Have we not many instances of similar compounds? Are not peroxide of hydrogen, manganic acid, &c. similarly composed? and are they not acted upon by the same causes, reverting to a compound containing less oxygen? But, to adduce analogies to air without hypothesis—may not oxygen and nitrogen, as simple undecomposed gases, remain mixed without framing laws for them contrary to other kinds of matter? May they not be held together, for instance, by the same attraction as that which operates between sulphuric acid and water? If we assume liquid sulphuric acid to be composed of S + 4O + H, does not this combine with water in any proportion, and *vice versa*, and yet form a compound held together by the operation of chemical affinity? Why, then, cannot oxygen and nitrogen remain *mixed* in the atmosphere by the same laws which keep together the particles of liquid sulphuric acid and water?

If we consider sulphuric acid with one atom of water as constituting a sulphate of protoxide of hydrogen, the same analogy will be perceived. We cannot call these instances of chemical combination in fixed proportion, unless we assume that it "depends upon some peculiarity, or resemblance in the form of their ultimate particles;" but to carry the analogy still further, cannot we separate *all* the sulphuric acid from the water by means of bodies which present a greater attraction for the acid, the water remaining inert in these cases? So can the oxygen be easily separated from the nitrogen; and does not the nitrogen remain inert, acting in air merely as a diluent to restrain the rapid action of the oxygen? for, were oxygen to have the ascendancy, all things would run into ruin and decay. It is true we can mix gases in any proportion, and they will remain suspended in each other; this again agrees with water and sulphuric acid. The question may arise—will sulphuric acid rise through a tube 30 inches long, and $\frac{1}{3}$ inch diameter, and the water descend? That such is the case, I have proved by experiment, for by coloring the water with litmus the rise of the acid is shown.

In Dalton's experiment with gases it took three hours to effect a mixture, but here we have two gaseous bodies, which are easily affected by a slight increase of heat, and have free motion amongst their particles. The experiment detailed above took days to produce, and we might suppose such to be the case in matter which is dense, and has not such mobility amongst its particles, that a much longer time would be required. This tends again to support the analogy, and also to answer the argument of Donavan—for the particles of gas, or liquid, near each other would first exert their affinity and combine; they then would react on the particles next to them, and so on until they were all combined; this process would be quick or slow according to the intensity of the affinity between the bodies presented to each other: in one case they might combine with extrication of heat and light, diminution in bulk, and change of properties; in other cases no such effect would be produced; such then is the case under consideration. It thus offers no violence to existing laws, nor requires different laws to preside over one kind of matter than those which govern another. It would account for the discrepancy which is noticed in our best analyses, and the reason why watery vapor, carburetted hydrogen, carbonic acid, &c., could remain suspended in the atmosphere, upon the same reason, as Dr. Prout judiciously remarks, "as the sea contains a little of everything that is soluble in water, so the atmosphere may be considered to contain a little of everything that is capable of assuming the gaseous form," and of existing in the atmosphere without decomposition.

Many other arguments could be adduced, but I trust sufficient has been said to prove that the hypothesis of Dalton is at variance with established facts; the experiments of Dumas, before quoted, find the composition of the atmosphere the same at every height. Dalton's theory indicates a diminution of of oxygen as we ascend in the atmosphere. Donavan's hypothesis cannot be admitted; whereas, by considering the diffusion of gases as owing to chemical affinity, it tends to harmonise, and bring all kinds of matter under the same laws.

ON SOME PRINCIPLES OF WHITE CINNAMON.*

BY WÖHLER.

Meyer and Reiche undertook, at the invitation of Wöhler, investigations concerning the principles of white cinnamon (*costus dulcis*). The following are the results:—

I. MANNITE.

Petroz and Robinet first demonstrated the existence of this principle in the bark; but they left undecided the question as to whether it is really mannite. The present investigations have proved that this principle does not differ from ordinary mannite. The bark contains a very large quantity of it—about eight per cent. If it be boiled with water, and if the liquor be evaporated, a great quantity of an extract of a slightly bitter and acid taste is obtained: boiling alcohol removes mannite from the latter, and this mannite may easily be obtained colorless by several crystallisations. The portion insoluble in alcohol contains, besides other principles, starch and many salts, particularly a calcareous salt.

II. ESSENTIAL OIL.

Ten pounds of bark gave by distillation with water 12 drachms of volatile oil. It was lighter than water and had a strong aromatic odor. In another preparation, in which much less bark was employed, and in which the distilled water had been cohobated several times, an oil finally passed over which sunk in water.

The whole quantity of crude oil obtained was left for several days, frequently stirred, in contact with a concentrated solution of potassa: the mass was then diluted with water, and the oil was extracted by distillation. The greater part of the oil distilled

* *Annalen der Chemie und Pharmacie.*

floated on the water, but there finally passed over an oil which sunk to the bottom of the vessel.

So small a quantity of this heavy oil was obtained, that only one analysis of it could be made, which was defective. This oil had a peculiar odor, not comparable with that of another oil. It was not possible to combine it with potassa.

The solution of potassa, from which the oil had been extracted by distillation, was separated by filtration from a small quantity of a deep brown semi-resinified oil, which also floated on the surface; it was then saturated with sulphuric acid, it became milky, and was afterwards distilled. There was obtained, but in small quantity, an oil heavier than water, sufficiently characterised by its odor resembling oil of cloves (caryophillic acid). It easily and completely dissolved in potassa and was again separated from it by the acids.

The light oil, which formed the greater part of the whole oil, greatly resembled in odor oil of cajeput: it was submitted with water to a fractioned distillation.

The portion which first passed over boiled at 356°F. It contains in 100 parts:—

Carbon	75·25
Hydrogen	11·28
Oxygen	13·46

Another portion of this oil was distilled alone and very slowly in an oil bath of the temperature of 330°F. until about half was distilled over. It presented the following composition.—

	I.	II.
Carbon	79·12	79·09
Hydrogen	11·58	11·71
Oxygen	9·30	9·20

The portion of oil which came over last was by fractioned distillation with water, and whose odor likewise greatly resembled that of oil of cajeput, had a specific gravity = 0·941 and its boiling point amounted to 473°F. It was formed of

	I.	II.
Carbon	80·56	80·52
Hydrogen	10·66	10·88
Oxygen	8·78	8·60

It is to be regretted that the total quantity of crude oil at the disposal of the operators was too small to allow of new investigations with the view of arriving at a more exact separation, and at a more accurate analysis of these different oils; but, at all events, this work shows that the oil extracted from white cinnamon, is probably formed of four different oils: one of them is certainly identical with oil of cloves, and another is probably identical with the most important principle of oil of cajeput.

III. ASH OF THE BARK.

The bark dried in the air left, after combustion, nearly six per cent. of ash. The latter contained nearly 86 per cent. of its weight of carbonate of lime, and not quite two per cent. of silica. It contained only a small quantity of carbonate of potassa, but it contained altogether more than four per cent. of potassa and 1·3 per cent. of soda; the other bases were, magnesia, peroxide of iron, oxide of manganese, and alumina. The bases were partially combined with chlorine, and sulphuric and phosphoric acids. About 2·5 per cent. of phosphate of protoxide of manganese was found.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

IMPROVEMENTS IN PHOTOGRAPHY*.

BY WILLIAM HENRY FOX TALBOT.

The first part of these improvements consists in removing the yellowish tint of pictures taken on calotype and other photographic paper, which has been prepared with a solution of nitrate of silver, by plunging the picture into a hot-bath, composed of hyposulphite of soda (or any other soluble hyposulphite) dissolved in ten times its weight of water, and heated to nearly the boiling point; the picture should remain in the bath about ten minutes, and be then washed in warm water, and dried. By this means the picture is rendered more permanent and transparent, and its lights become whiter. After undergoing the above operation, the transparency of calotype pictures may be increased by causing melted wax to penetrate into the pores of the paper. Under this improvement, the patentee claims the employment of hot or boiling solutions of the hyposulphites, in order to give increased whiteness to calotype and other photographic pictures, and at the same time make them more permanent; also the process of waxing

* *London Journal and Repertory of Arts*, January, 1844.

a calotype picture; but only in case the said picture has been previously whitened, or rendered more transparent, by plunging it in a hyposulphite solution, or otherwise.

The second improvement consists in placing in a warm plate of iron behind the paper-holder, during the process of taking a calotype picture with the camera, to communicate warmth to the prepared paper, and thus render it more sensitive. Claim :—The process of warming the paper during the formation of the picture.

The third improvement consists in preparing what the patentee terms iogallic paper, by washing a sheet of iodised paper with a saturated solution of gallic acid in water, and then drying it. This paper will keep good for a considerable time, if placed in a portfolio or press; and, when wanted for use, it may be rendered sensitive to light, by means of a solution of nitrate of silver. Claim :—The preparation and use of the iogallic paper, as above described.

The fourth improvement consists in washing iodised paper with a mixture of twenty-six parts of gallic acid, and one part, or thereabouts, of nitrate of silver (the solutions being of the strength usually employed in the calotype process); it can then be dried before a gentle fire, without being spoiled. It is not quite so sensitive to light as the ordinary calotype paper, but it can be used in a dry state, whereas the calotype paper must generally be used in a moist state, as there is some difficulty in making it quite dry, without more or less injuring it. Claim :—The employment of iodised paper, excited or rendered sensitive by a liquid, containing only a small portion of nitrate of silver, and subsequently dried, so as to retain its sensitive state.

The fifth part of the invention relates to a method of improving the appearance of photographic pictures. A copy or reversed impression of a photographic picture is taken in the ordinary manner, except that it remains in the light twice the usual time; its shadows are thus rendered too black, and its lights not sufficiently white. It is then washed and plunged into a bath of iodide of potassium (of the strength of five hundred grains to each pint of water) for one or two minutes, which makes the picture brighter, and its lights assume a pale yellow tint. After this, it is washed, and immersed in a hot-bath of hyposulphite of soda, until the pale yellow tint is removed, and the lights remain quite white. The pictures thus finished have a pleasing and peculiar effect of light and shade, which is not easily attainable by other means. Claim :—Producing a change, by means of iodide of potassium, in the relative intensity of the lights and shades of a photographic copy, subsequently to its first formation, and giving permanence, by a fixing process, to the picture so changed.

The sixth improvement consists in waxing photographic pictures, to render them more transparent, and then placing a sheet of white or colored paper behind them.

The seventh improvement consists in obtaining enlarged copies of Daguerréotype and calotype portraits and other small photographic pictures, by throwing a magnified image thereof, by means of lenses, on a sheet of calotype paper, thus producing a magnified negative copy, from which position copies can be obtained in the usual manner. Claim :—Obtaining enlarged portraits and pictures by a double photographic process, as above described.

The eighth improvement relates to photographic printing. A few pages of letter-press are printed on one side only of a sheet of paper, which is waxed, if thought necessary, and the letters are cut out, and sorted; then, in order to compose a new page, a sheet of white paper is ruled with straight lines, and the words are formed by cementing the separate letters in their proper order along the lines. The page being completed, a negative photographic copy is taken from it, having white letters on a black ground; this is fixed, and the required number of positive copies is thus obtained. Another method is, to employ larger letters painted on the rectangular pieces of wood, colored white and forming pages, therewith, by arranging them in rows, on a tablet or board, suitably grooved for that purpose; a copy (of the size desired) is then taken, on sensitive paper, by a camera obscura. Claim :—The application of photography to printing, by arranging suitable letters or figures, so as to form pages, and making photographic images thereof.

The last part of the invention relates to what the patentee terms photographic publication; that is, producing a number of positive photographic copies of a picture or print, for the purpose of sale. The objects most suitable for such publication are prints, engravings, drawings, letter-press, maps, music and similar productions. Copying paper is first prepared, by taking good writing paper, without water-mark, and diffusing it in a salt-water bath, consisting of three or four ounces of salt to each gallon of water; it is then wiped and dried. After this, it is washed in a solution, formed by mixing one hundred grains of nitrate of silver with two ounces of distilled water, then adding a sufficient quantity of ammonia to form a precipitate, and redissolving the same, leaving the solution clear. When dry, the paper

may be used for obtaining a negative copy of any print or picture, by placing it in contact therewith, in a copying frame (consisting, essentially, of a piece of glass, with a board at the back, and tightening screws, as described in the specification of Mr. Talbot's patent of February, 1841,*) and exposing it to the light, until the negative copy is produced. The negative copy is fixed by a hot solution of hyposulphite of soda, as before described, and may also be waxed; the requisite number of positive copies are then obtained from it, and are fixed in the manner above mentioned. Claim:—The system or combination of these several processes in one, whereby a new and useful result or branch of manufacture is produced: namely, the multiplication of very permanent and perfect copies of the positive kind; and which system consists essentially of four parts, viz.:—Firstly, the formation of the negative copy. Secondly, fixing it so that it shall have the requisite transparency, and be free from irregular opaque streaks in the interior of the paper, and also that it may endure, without change, great subsequent exposure to the light. Thirdly, the formation of the positive from the negative copy; and, lastly, its permanent fixation.

EMPLOYMENT OF IODIDE OF POTASSIUM IN CHLORIMETRY.†

BY J. L. LASSAIGNE.

It is more than a year since we proposed iodide of potassium in solution of known strength for estimating the proportions of chlorine contained in the alkaline hypochlorites of commerce. This process, which, as it appeared to us, should supersede the indigo system of chlorimetry, is based, as we formerly proved, on the quantity of free chlorine necessary for completely decomposing a known proportion of pure iodide of potassium dissolved in a known weight of distilled water, and to convert it into chloride of potassium and perchloride of iodine—the aqueous solution of which is colorless.

In order to appreciate the decomposition, we added to the solution of iodide of potassium a little dissolved starch, in order to recognise by the color of the iodide of starch produced the moment at which the decomposition is finished; but this addition is not useful, as we proved some months ago.

The orange-yellow coloration which the solution of iodide of potassium takes, and its decoloration at the moment when the operation is terminated may serve as a guide and dispense with the use of starch. The comparative experiments which we have recently made have demonstrated to us that the results were absolutely the same, with or without the addition of starch to the solution of iodide of potassium, which renders still more simple the chlorimetric method we propose.

The calculations which must be made, in order afterwards to ascertain the proportions of chlorine, are the same as those indicated in our first memoir (*Journal de Chimie Médicale*, t. viii., page 745). We here detail them with the simple means of performing the operation.

A volume of a solution of iodide of potassium, of known strength, is measured in the pipette of the chlorimeter, and is placed in a bottle or drinking glass; then, after having added one or two drops of pure and concentrated sulphuric acid, in the swan-necked, graduated cruet, the operation is terminated when the solution of iodide of potassium, which is colored in consequence of its decomposition and by a portion of iodine liberated, resumes the limpidity of pure water. This is easily ascertained, by placing the vessel in which the operation is conducted on a sheet of white paper.

In order to ascertain the proportion of chlorine contained in the alkaline hypochlorite, the quantity which has been employed is noted by measure.

Supposing that this quantity be equivalent to 0·5 of a division of the cruet, the following proportion is established:—

$$1:0{\cdot}5::x:1$$
$$x = 1 + 1 \text{ or } 2$$

$$\frac{}{0{\cdot}5}$$

This result would then indicate that the solution of hypochlorite assayed contains exactly two volumes of chlorine.

The comparative examination of this method, by employing the solution of iodide of potassium to which starch had been added, furnished the following results with a solution of hypochlorite of potassa.

1 volume of solution of pure iodide of potassium required, to be completely decomposed	0″ 255 in the solution of hypochlorite.
1 volume of solution of iodide to which a little starch had been added	0″ 240 of the same solution.

* See *London Journal and Repertory of Arts*, vol. xix., p. 189, conjoined series.

† *Journal de Chimie Médicale*, January, 1844.

In another assay, with a solution of hypochlorite of soda, the quantities of this compound in two trials made, were : :6·40:6·35.

This means appears to us to present sufficient accuracy for the various wants of the arts and commerce, and may, perhaps, with some advantage, replace the indigo system.

ON THE APPLICATION OF ZINC BY THE PROCESS OF ELECTRO-DEPOSITION FOR THE PRESERVATION OF IRON, AS APPLIED TO ENGINEERING AND OTHER PURPOSES.*

BY FREDERICK PELLATT.

(*Read before the Society of Civil Engineers.*)

The object of the paper is to direct attention to the properties of zinc as a protecting coating for iron; to describe the processes already employed for that purpose, the reasons of their failure, and the peculiar fitness of the process of electro-deposition of metal for the purpose.

Iron is, it is stated, from its superior affinity for oxygen, liable to rapid decomposition, and it has ever been a desideratum to discover some cheap mode of protecting it; the ordinary method of painting and tinning not being sufficiently lasting.

By the laws of electricity, when metals are in contact, the negative metal is protected at the expense of the positive; and, under all ordinary circumstances, zinc being the positive metal, it becomes a protector to the negative metal, iron. Zinc, like most metals in commerce, is not to be met with pure; in the other metals, however, the impurities do not generally tend to the injury of the metals with they are combined: such, however, is not the case with zinc and its impurities, as when in contact with moisture, they generate a galvanic action by which the zinc is rapidly destroyed.

Those who have made use of zinc, especially where it has been exposed to exciting fluids, such as milk, or any other fluid easily converted into acid, are well aware of the rapidity of its destruction.

The impurities existing in ordinary zinc are then noticed, as well as the difficulty and costliness of the process of the sublimation, in order to refine it. It is also contended that impure zinc, being in itself so easily destructible, is of little value, as it cannot afford protection to any other metal which may be coated with it; and, therefore, the mode of plating iron with melted zinc (of commerce) must be objectionable.

The report made to the French Academy by Monsieur Dumas, is quoted, in which he says—"The tinning of iron by steeping it in a bath of melted zinc has many inconveniences; beside, the iron combining with the zinc, constitutes a very brittle superficial alloy, the iron losing its tenacity. The presence of foreign matters used in the process, in order to keep the zinc in fusion, increases the amount of impurity, and, being less fusible than the zinc, a great loss is created, in consequence of the zinc volatilizing at a high temperature.

It is well known that, in the deposition of metals from metallic salts by the electro-process, the pure metal only is deposited, so that the process described in the paper is not open to the objections against ordinary metallic coatings. The iron also being coated with zinc, in a cold solution, its state is in no way damaged. The expense of the process is stated not to exceed that of four coats of oil paint.

Though to men of science the properties of zinc in connection with other metals have been well known (and the opinion of Drs. Graham, Kane, Daniell, and Monsieur Dumas are quoted on the subject), yet, practically, this knowledge has not been much applied, chiefly from the difficulty of obtaining pure zinc. The electro-process, it is stated, entirely overcomes the difficulty; at the same time it affords facilities for covering ironwork of any form or size; and, as it requires no great outlay, the process may be carried on in any locality.

Zinc has another great advantage; although it is easily oxidised, the oxide in ordinary circumstances is insoluble, and affords a protection to the metal below. For roofing, and many other purposes, of which a long list is given, it is suggested that tinned iron would be found very useful.

Mr. F. Pellatt exhibited a number of specimens of iron, covered with zinc and copper, by the process of electro-deposition, which he described. The pieces of iron were first rendered perfectly clean and free from oxide, by plunging them into a bath of heated sulphuric acid and water; they were then placed in a cold solution of sulphate of zinc. The positive pole of a galvanic battery being attached to a zinc plate, and the negative pole to the piece intended to be covered with metal, the deposition commenced equally all over it, and was continued as long as was considered necessary. By this

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* *London Journal and Repertory of Arts, Sciences, and Manufactures,* Jan. 1844.

* *London Repertory of Arts,* Jan. 1844.

process the pure metal alone could be deposited; and the amalgamation of the zinc and iron, which occurred when the iron plates were dipped into melted metal, was avoided. For zincing, he preferred an acid to an alkaline solution of the metallic salts. Some thin plates, which had been exposed for eight months on roofs in London, did not exhibit any appearance of rust. The process could be adopted on any scale, as all the apparatus that was necessary was some wooden troughs, to contain the solution and the pieces of metal to be covered.

He had not made accurate experiments as to the efficacy of the process when applied to iron exposed to the action of sea-water; but he feared the result, on account of the formation of muriate of zinc.

The president said that the subject was one of great importance to engineers, as, if the deposited coating were found to stand the test of time, it would enable the use of iron to be exended; but the main point to which he would direct Mr. Pellatt's attention, was the defence of cast iron from the destructive action of sea-water.

ON THE CALIBRE OF ROCKETS, AND ON A BLUE FIRE.

To the Editors of The Chemist.

Gentlemen,—

On reading Mr. Marsh's interesting paper in your number for this month, I observed an error in the dimensions of rockets, which ought to be corrected as soon as possible. It is stated (page 26), that "the length of the spindle is equal to $3\frac{1}{2}$ interior diameters of the rocket." For *interior* read *exterior* diameters; or you may read—interior diameters of the *mould*, instead of the *rocket*. (It is evident that the interior diameter of the mould is equal to the exterior diameter of the rocket, since the latter fits tight into the mould.) In corroboration see *Griffiths' Artillerists' Manual*, 3rd edition, pp. 245-6; or draw a rocket according to the proportions given in your Magazine, and its *dumpy* appearance will at once shew it to be a mistake. I have myself made rockets for my own amusement, in which the spindle is equal to 7 interior diameters of the rocket, or $4\frac{2}{3}$ exterior diameter, and they succeed admirably.

The diameter of a 1*lb.* leaden ball is the diameter of the *exterior* of a 1*lb.* rocket: this was not stated clearly enough. In fact, the 1*lb.* ball fits exactly into the mould for this sized rocket; whence men, accustomed to name guns from the size of their balls, would naturally call such a mould a 1*lb.* mould, and the rocket itself a 1*lb.* rocket.

In like manner any other calibre is named from its coinciding leaden ball; only, be it always remembered, that it is the calibre of the *mould*, and not of the *interior* of the rocket.

I am, gentlemen,
Your obedient servant,
V. de P.

Allow me to contribute a very fine blue fire, to burn loose or in pans.

	Parts.	Or according to Mr. Marsh's Centesimal Notation. gr.
Saltpetre.....	5	62·5
Sulphur	2	25·0
Regulus of Antimony..	1	12·5
		100·0

The improvement consists of using metallic antimony instead of the sulphuret; for it is the actual formation of the sulphuret which here contributes considerably to the evolution of light. This effect is entirely lost in the common blue fire, made with sulphuret of antimony.

London, Jan. 22, 1844.

IMPROVEMENTS IN EXTRACTING COPPER, IRON, LEAD, BISMUTH, AND OTHER METALS, FROM TIN ORES.*

BY JOHN MITCHELL.

This invention consists in separating from tin ore the small quantities of copper, iron, lead, bismuth and other metals or minerals mixed with it; and which, although existing in very small quantities, materially affect the quality of the tin. This is effected by dissolving them in such acids as will not act injuriously upon the oxide of tin.

The tin ore is pulverised, as usual, and the greater portion of the matrix separated by washing. It is then (by preference) calcined, and afterwards treated with acid, to dissolve the foreign metals or minerals, which may then be readily washed away. The best time for submitting the ore to the action of acid, is before it becomes cool, after removal from the calcining furnace; and it should be allowed to remain in the acid for three or four days, or for a longer period, if found necessary.

Muriatic acid is preferred by the patentee, diluted with an equal quantity of water, and employed in the proportion of one hundred weight of the ordinary acid of commerce to each ton of ore.

* *London Journal and Repertory of Arts*, January, 1844.

When the foreign metals are in the state of oxides, it will not be absolutely necessary to calcine the ores before operating with acid; and, in some cases, it may be desirable to apply heat to expedite the process, and lessen the quantity of acid employed, by putting the ore and acid into earthenware vessels, heated by a sand-bath.

The patentee does not confine himself to the use of liquid acid, as the acid evolved in the state of vapor, by various processes, may be employed. He claims the mode of purifying tin ore, by extracting foreign metals or minerals by dissolving them in acid, and washing them off or separating them, as above described.

METHOD OF REMOVING MARKING INK FROM LINEN.*

BY DR. BOETTGER.

I recollect having read some time ago in a chemical or polytechnical paper an essay in reference to the foregoing question, in which the use of aqua regia was recommended; but, besides that this powerful agent will hardly ever generally be employed by the female sex for the removal of names and figures from fine cambric, lawn, and linen handkerchiefs, a doubt as to its efficacy can hardly be suppressed; but not having had an opportunity of putting this method to the test, I abstain from giving any contrary decision, and at once proceed to communicate a means producing the effect with certainty, at the same time in no way injuring the materials, which will be interesting to many, and principally to chemists.

The substance to be employed consists simply of a somewhat concentrated solution of the cyanide of potassium of Liebig.

Here I may be allowed to remark that the pure cyanide of potassium employed to form this salt must be free from sulphate of potassa, in order wholly to prevent the formation of a combination with sulphur during the calcination, which might interfere with the object in view. The said precaution in forming the cyanide of potassium should never be lost sight of by those who make gold or silver solutions.

Writings made with chemical marking-ink on white bodies, table linen, towels, &c., of some years' standing, were in a very short time removed by gently rubbing the materials with a somewhat concentrated solution of cyanide of potassium, no injury whatever being perceptible even in the finest fabric. If a little common writing-ink enter into the composition of marking-ink (which sometimes is done with the intention of improving the freshly-made figures), then, in addition to that, the spot or figure to be removed must afterwards be treated with a hot concentrated solution of oxalic acid.

The black and reddish spots produced on the skin by solutions of gold and silver, are also in the same manner easily removed by the before-mentioned saline solution.

* *Annalen der Chemie und Pharmacie*, Band xlvii., Heft 3.

ON A SIMPLE METHOD OF DISCOVERING COTTON THREADS IN LINEN TISSUES.

BY DR. BOETTGER.

After reviewing different methods proposed for accomplishing the said purpose, and showing them to be insufficient, the author gives a description of his own process, as follows:—A square inch of the linen to be examined is to be put into a mixture of equal parts of hydrate of potassa and water when very strongly boiling, and allowed to remain there for two minutes, then taken out from the silver or porcelain capsule with a glass rod, and without being previously washed with water, gently pressed between doubly-folded white blotting paper; next six or ten threads in each direction of the linen are separated, when it will instantly appear which are the cotton and which the linen threads: the dark yellow ones are linen, and the white or bright yellow ones cotton.

It is understood that this infallible method is easily performed by anybody; it can only be employed when the tissue is white, and not when colored.

MEMOIR ON THE DISTRIBUTION OR APPROPRIATION OF LANDS.*

BY PROFESSOR LIEBIG.

(*Continued from page* 71.)

To the plants containing *potassa*, belong the chenopodées, the *arroctres*, the *absinthium*, &c., and among cultivated plants, the beet-root, the turnip, and maize; to plants containing *lime*, the lichens (which contain oxalate of lime), the cactus (which contains crystallised tartrate of lime), clover, beans, peas and tobacco; to plants containing silica, wheat, corn, rye and barley:—

* *Annalen der Chemie and Pharmacie.*

		Salts of potassa.	Salts of lime and magnesia.	Silica.
Plants containing silica.	Oat-straw, with the seeds (*a*)	34·00	4·00	62·00
	Wheat-straw, (*b*)	22·00	7·00	61·05
	Barley-straw, with the seeds (*a*)	19·00	25·70	55·0
	Rye-straw (*c*)	18·65	16·52	63·89
Plants containing lime.	Havannah tobacco (*d*)	24·34	67·44	8·30
	German tobacco (*d*)	23·07	62·23	15·25
	Tobacco of artificial soil (*a*)	29·00	59·00	12·00
	Pea-straw (*d*)	27·82	63·74	7·81
	Stalks and leaves of potatoes (*e*)	4·20	59·40	36·40
	Clover (*a*)	39·20	56·00	4·90
	Maize straw (*b*)	71·00	6·50	18·00
	Turnips (*f*)	81·60	18·40	
	Beetroots (*c*)	88·00	12·00	
	Tubercles of potatoes (*c*)	85·81	14·19	
	Helianthus tuberosus (*g*)	84·30	15·70	

This division does not present, as is evident, very strict limits: a great number of sub-divisions might be established, especially as regards plants in which the alkalis are susceptible of being replaced by lime and magnesia. In the present state of the progress of our observations, our cultivated plants present a substitution of soda for potassa; but the substitution of lime for the alkalis has not yet been observed.

Thus, the potatoe belongs, with respect to the principles of its leaves, to the plants containing lime, and with regard to those of its tubercles (which contain only undetermined traces of lime), to plants containing potassa.

It is especially in plants containing silica that these differences are observed.

It is easy to see that, compared with oats and wheat, with reference to the principles soluble in hydrochloric acid, barley belongs to plants containing lime; whilst the quantity of silica which it contains should rank it among silicious plants. It is thus that the beet-root contains phosphate of magnesia, and only traces of lime, and the turnip phosphate of lime, and only traces of magnesia.

The quantity of ashes, and the knowledge of their composition, admits of a facility of calculating what principles, and in what degree each kind of plants (plants containing *silica*, *lime* and *potassa*) exhausts the soil.

The following example comprises this reasoning. There was removed from the soil (four Hessian acres) in one crop, by :—

		Salts, with alkaline bases.		Salts of magnesia of peroxide of iron.		Silica.	
						lb.	lb.
Of wheat.	In the straw	95·31	130·51	34·75	67·55	260·05	
	In the grain	35·20		32·80			
Of peas.	In the straw	154·40	198·42	354·08	370·76	46·60	
	In the seed	44·02		16·68			
	In the straw	40·73	82·78	36·00	57·82	139·77	
	In the grain	42·05		21·82			
	Beet-roots, without leaves	,,	361·00		37·84	,,	
	Helianthus tuberosus ..	,,	556·00		184·00	,,	

These crops removed in phosphates from this surface of the soil (1) :—

The peas (2).	The wheat.	The rye.	The artichoke.	The turnip (3).
117.	112·43.	77·05.	122.	

(*a*.) Wiegmann and Polstorff.
(*b*.) De Saussure.
(*c*.) Fresenius.
(*d*.) Hertwig.
(*e*.) Berthier and Braconnot.
(*f*.) Hruschauer.
(*g*.) Braconnot.

(1). We have, in these numbers, a ratio, not exact, but approximate, of the principles of the soil which the different crops removed. It was the proportion of the ashes, according to the determination of M. Boussingault (*Annales de Chemie et de Physique, t.* 1, 3*rd série*), which served as the basis of calculation. Advantage was taken of the analyses of ashes, as well as those hitherto known permitted—that of the seed and straw of wheat is from De Saussure; that of pea-straw, from Hertwig; that of peas, from Will; that of the ashes of the straw and seed of rye, from Fresenius; that of beet-roots, from Hruschauer; that of the Helianthus tuberosus, from Braconnot. Exact and

According to the foregoing, plants receiving certain principles from the soil on which they arrive at their complete development, formation, and fructification, we see their development confined within very narrow limits in pure water, in pure silica, or in a soil in which these principles are wanting; if they do not receive alkali, lime, or magnesia, there will be formed only a quantity of stems, leaves and flowers corresponding to that of those substances in reserve in the seed. If phosphates be absent, the development of the seed does not take place.

The more prompt the development of the plant is, the more rapidly its leaves increase in number and size, and the more considerable should be the proportion of alkaline bases, which it receives in a given time.

It is clear that if all plants indistinctly remove certain principles of the soil, none can render it fit for another kind of plants. If in countries in which vegetation has not changed from time immemorial, we transform the forest into cultivated land, if we spread on the soil the ash of the trees and shrubs cut down, we have added a fresh provision of alkaline bases and phosphates to those found in the soil, and it suffices for a hundred or more crops of certain plants.

If this soil contain silicates of easy decomposition, it presents to us the soluble silicate of potassa or soda necessary to the development of the stems of silicious plants: the phosphates found in an earth of this nature, present all the conditions of the production of cereals during an uninterrupted series of years.

If these silicates were wanting in this soil, or if it contained only limited quantities of it; if it contained, on the contrary, a great quantity of calcareous salts and phosphates, we could grow in it, during a certain number of years, tobacco, peas, beans, &c.

If we do not restore to the soil any of all these substances which it has yielded to plants, a time must arrive when it can no longer furnish any of these principles for a fresh vegetation, and when it must be completely exhausted, completely sterile even for bad herbs.

According to the inequality in the proportion of these different substances, this state of barrenness will arrive sooner for one kind of plants than for another. If the soil be rich in silicates, but poor in phosphates, the cultivation of wheat will exhaust it more promptly than that of oats or barley, precisely because in one crop of wheat we remove more phosphates in the seed and straw than in three or four crops of barley or oats (*). If this soil be wanting in lime, barley will grow on it only imperfectly.

It is the want of these salts, indispensable to the formation of the seed, which is the cause if, with a great excess of silicates, the quantity of grains of wheat which was one year = 9 in the following years on the same ground is only = 3 or 2.

On the same soil, rich in alkaline silicates, and containing a limited quantity of phosphates, the period of the exhaustion of these salts arrives later, if we alternate wheat with plants which are gathered before the production of the seed, or, which amounts to the same, which take up only a small quantity of phosphates.

If we cultivate on this soil peas or beans, they will leave after the crop, silica in the soluble state and in sufficient quantity for a subsequent crop of wheat; but these plants will exhaust it of phosphates, almost as

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positive numbers will be obtained only by determining the proportion of ashes of the products gathered on a given suface, and submitting these ashes themselves to analyses, and not by operating as above, in which the analysis relates to the ash of a plant, coming from another country, grown on another soil, and in other conditions. It is thus, for example, that M. Boussingault obtained, from pea-straw (from a powerfully-manured soil), 11·2 per cent. of ash; De Saussure, only 8 per cent., with the seeds, and Hertwig only 5 per cent. These numbers change the absolute quantity; but they have little or no influence on the relative proportions.

The analysis of ashes, made by Sprengel, cannot be turned to account, because they are entirely false, and deserve not the slightest confidence. It is thus, for example, that the ashes of the seeds of wheat, peas, Windsor beans, rye, &c., are formed of phosphate without any mixture of carbonate; these ashes do not contain silicic acid. Sprengel found in peas 18 per cent., and in rye 15 per cent. of silica. The ash of the seeds of rye contains 48 per cent., and that of peas 34·23 per cent. of anhydrous phosphoric acid. He indicates in peas 4 per cent., and in rye 8 per cent of phosphoric acid. It is worthy of remark, that all the bases are contained in the ash of peas in the state of tribasic phosphates; and in that of rye in the state of tribasic phosphates.

(2.) With abundant manure.

(3). With abundant manure.

* The weight of the ash of a crop of seeds of wheat is to that of a crop of oats as 31 to 42·6: the phosphates contained in it are as 26 to 10, without reckoning the phosphates of the straw.

powerfully as wheat itself, because a nearly equal quantity is required for both these kinds of plants.

It is by alternating with tobacco, with potatoes or clover, consequently with plants whose seeds are very small and contain proportionally only very little phosphates, whose tubercles and leaves require only very small quantities of them for their developement, that we are able to retard the exhaustion of the soil of phosphates; but each of these plants has, to a certain degree, increased its poverty in phosphates; we have, by alternating with other plants, delayed the period of exhaustion: we have gathered a more considerable weight of sugar, starch, &c., but we have gained nothing in alimentary substances properly so called—in principles of the blood. If the soil is poor in calcareous salts, tobacco, clover and peas do not thrive in it, all other conditions being equal, without injuring the vegetation of beet-roots and turnips, supposing that the alkalis be not absent.

If, on a soil which contains silicates of difficult or slow decomposition, the liberation of a sufficient quantity of silicic acid for a crop of wheat be operated in the natural state of this soil, by the influence of the atmosphere only in the space of two or three years, supposing that the phosphates necessary for the formation of the seed be not absent, we can cultivate wheat on this field only every three years. We may shorten this interval, accelerate the decomposition, and procure a greater provision of soluble silicates, by augmenting the surface of the soil and rendering it more permeable to the air and to moisture by mechanical means, or else by favoring the decomposition of the silicate by the employment of calcined lime; but it is certain that all these means, although insuring to us for a certain time richer crops, must increase the loss of the natural fertility of the soil.

If the proportion of alkali and silica set at liberty in three or four years be sufficient for only one crop of wheat, if, consequently, there be no more free and disposable alkali, we cannot in the interval cultivate any other plant on the same soil, without prejudice to the crop of wheat; for the alkali necessary for the developement of this plant cannot be employed for the benefit of wheat.

From the known proportion of alkali and silica set at liberty in the decomposition of the silicates, (*) it results that, for a given quantity rendered soluble, the soil receives a much greater quantity of alkali, likewise in the soluble state, than corresponds to the proportion in which straw contains these two bodies.

In the interval which we should place in the last case between the two crops of wheat, we may, therefore, employ the excess of alkali in the culture of another plant, requiring salts with an alkaline base, but not silica in the soluble state. We may cultivate beet-roots, or even potatoes, before wheat, not removing from the ground the stalks and leaves of the latter, which are rich in silica.

We have in the foregoing considered the changes of nature and composition undergone by a field on which, during a certain number of years, a series of cultivated plants were grown.

If this field contains a sufficient proportion of alkaline silicates, alumina, lime and magnesia, there will be a proportionally inexhaustible provision of alkalis, alkaline earths and silica, with this difference, however, that it is not everywhere and in equal times applicable to the vegetation of the plant. By mechanical, as well as by chemical means, (lime, &c.,) we may abridge the time that these substances require for assuming a form appropriate to the vital functions of the plant; but they are not sufficient for allowing a perfect developement of the plant.

If phosphates and sulphates be absent, the plant will not bear seeds, precisely because all the seeds, without distinction, contain combinations of which phosphoric acid as well as sulphur constantly forms part.

Whatever may be the excess of the other principles, the soil will become completely sterile if a time arrive at which it can furnish neither phosphates nor sulphates to a new vegetation.

We must admit that the formation of stems and leaves, the assimilation of carbon and the production of sugar, starch and ligneous fibre, require a certain quantity of alkali (for plants containing potassa), or an equivalent of lime (for plants containing lime); but we must believe that whatever may be the proportion of ammonia and carbonic acid introduced, there can be formed in the organism of the plant only a quantity of principles of the blood corresponding to the phosphates. The production of the sulphuro-nitrogenous principles of the sap is most strictly connected with their presence.

Every soil, on which however bad herbs attain their developement, is fit for culture, if the bad herbs leave by combustion an alkalius ash. The alkalis of this ash proceed from silicates; besides the alkali, soluble silica should be found.

A soil of this nature contains, perhaps, the quantity of phosphate of magnesia and phosphate of lime sufficient for a crop of potatoes

* For every equivalent of potassa which is separated from 1 eqv. of feldspath, 1 eqv. of silica is liberated. The straw of wheat, oats, and rye, contain, for 10 eqv. of silica, only 1, or at most 2 of alkalis.

or turnips, without containing, nevertheless, sufficient for a crop of wheat.

These considerations show the great importance which must attach to the phosphates in agriculture. These salts are always found in small quantities in the soil, and so much the greater attention should be paid to preventing its exhaustion of these principles.

Every one knows that, in the limited, though enormous, space of the sea, entire worlds of plants and animals exist; that one generation of these animals receives all its elements from plants; that the principles of their organs resume, after the death of the animal, the primitive form, in which they serve as nourishment for a new generation of animals.

The oxygen which marine animals remove in the act of respiration from the air dissolve in water, and which is so rich in that element (containing 32 to 33 of oxygen per cent., whilst atmospheric air contains only 21 per cent.), is restored to the water in the vital act of marine plants. It enters into the products of the putrefaction of the bodies of animals deprived of life; it converts their carbon into carbonic acid, and their hydrogen into water, whilst their nitrogen takes the form of ammonia.

We observe that, in the sea, without the addition or subtraction of any other element, an eternal circulation goes on, limited not in its duration, but in its extent, by the nourishment of the plant which is found contained in a space and in a limited proportion.

We know that with marine plants there can be no question of a transport of nourishment, of humus, by the root. What nourishment, can be drawn from a fragment of naked rock, on the surface of which not the smallest change is observed, by the root, of the size of a fist, of the *giant Varech*, a plant which attains the height of 117 metres (Cook), and one plant of which nourishes *thousands* of marine animals with its leaves and branches! These plants evidently require only a point of solid support which prevents change of place, or an object which counterbalances their low specific gravity; they live in a medium which furnishes to all their parts the nourishment which is necessary to them: sea water contains, not only carbonic acid and ammonia, but also the alkaline phosphates and carbonates and the earthy salts which the marine plant requires for its developement, and which we constantly find in its ash.

All observations demonstrate that the conditions which ensure the existence and duration of marine plants, are the same as those which maintain the life of terrestrial plants.

However, the terrestrial plant does not live, like the marine plant, in a medium which contains all its elements and surround all its organs; but it is destined to live in two media, one of which, *the soil*, contains the principles which are wanting in the other, *the atmosphere*.

(*To be concluded in our next.*)

EXPERIMENTS ON THE FERTILIZATION OF LANDS BY AMMONIACAL SALTS, NITRATES AND OTHER COMPOUNDS.*

BY M. F. KUHLMANN.

(*Concluded from page 75.*)

In a work on the efflorescences of walls, published in 1829,† I was led to prove the existence of a certain quantity of carbonate of potassa or soda in all chalks, and afterwards in almost all mineral matters. These observations, which led me to an opinion concerning the intervention of potassa in the formation by the humid way of most rocks, may serve to justify the existence of alkalis in plants, even in those which grow in entirely chalky soils. Nevertheless, it is difficult to believe that the potassa or soda found in plants in the state of salts of organic acid, are always presented to the plant in the state of carbonate or soluble silicate; it is most frequently in the states of sulphate and chloride. No one can dispute, for example, that marine plants receive most of their soda in the state of chloride. Now, there are different modes of explaining the reactions by which the salts of organic acid are formed by the displacement of the much more powerful mineral acid. The oxalic acid which is formed by the act of vegetation, and which gives an insoluble salt of lime, can very readily explain the decomposition of the chloride of calcium or sulphate of lime, taken up by the roots in the state of solution; but the salts of potassa or soda which are formed in the vegetables being soluble, the same reactions cannot interfere.

The phosphate of lime, like that of magnesia, may be taken up by plants in the state of solution in water charged with carbonic acid or alkaline bicarbonate,‡ or it may be the result of a double decomposition in plants by the simultaneous aspiration of soluble salts of lime and magnesia, and phosphate

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* *Comptes Rendus, &c.*

† *Annalen der Chemie und Pharmacie*, vol, XXIX; *Abhandlung uber die Salpeter Bildung.*

‡ I have proved, by direct experiments, that the phosphates of lime and magnesia are rather soluble in water, by means of carbonic acid and alkaline bicarbonates.

of potassa, soda or ammonia in presence of these alkaline bicarbonates. The existence of phosphate and sulphur in organic tissues is explained, by the decomposition of the sulphates and phosphates, under the oxidising influence of the putrid fermentation of manures.

But how do the alkaline chlorides come to give their base to organic acids?

I have every reason to believe that, in this transformation, the carbonate of ammonia—the ordinary result of the decomposition of nitrogenous manures, or the carbonate of ammonia resulting from the contact of hydrochlorate of ammonia and sulphate of ammonia with chalk under the influence of the sun, acts on the chlorides of sodium and potassium, converts them into hydrochlorate of ammonia and into carbonates of soda and potassa, susceptible of being saturated by the organic acids. These decompositions can be made only under the influence of moisture, and of a basic reaction of the earth, and this last condition causes to be comprehended all the efficacy of always maintaining the lands in the alkaline state by additions of lime, ashes, &c. &c.

The ammoniacal salts would, therefore, perform in the appropriation of the alkaline aliments by vegetables, the same part that I have assigned to these salts in the nitrification when it is required to convey the nitric acid to the lime and magnesia.

Having proved the presence of carbonate and nitrate of ammonia in the ley of saltpetre manufacturers, I was led to admit that the carbonates of lime and magnesia which form part of the earths susceptible of nitrification, exchange their acid with the ammoniacal nitrate which is thus brought to the state of carbonate. All these exchanges of acid are thus produced under the influence of an alkaline reaction, and under the influence of the sun.

I think that, in vegetation as in the act of nitrification, the ammoniacal salt intervenes not only by furnishing its nitrogen to the new formation either of nitric acid or of the nitrogenous principle of plants, but also as a means of transport or of decomposition, sometimes under the influence of the sun, sometimes under the influence of water, and that thus it powerfully assists in the fertilization of lands, as well by the nitrogen which it furnishes to the plants, as by the potassa or soda of the chloride which it disposes for assimilation by plants, in the state of salt of organic acid.

I will not dwell any longer on these considerations: they repose on conjectures which I leave to the appreciation of chemists.

If my results be compared with those which have led M. Bouchardat to form conclusions so contrary to mine, we shall be led, I think, to admit that M. Bouchardat, by plunging in bottles containing solutions diluted to $\frac{1}{1000}$ or $\frac{1}{1500}$ of ammoniacal salt, branches of different vegetables, did not furnish these salts to vegetation in the ordinary conditions; but that he threw into the circulation of these plants too considerable quantities of undecomposed ammoniacal salts. M. Bouchardat proves, however, that cabbages placed each in a box containing earth mixed with good garden mould, having been watered with dilute ammoniacal salts, did not die.

M. Bouchardat, in order to explain these results so different from the first, says that, in the latter experiment, the ammoniacal salts were not absorbed, but were retained by the mould.

However, the work of M. Bouchardat having been made known to me only through the extract of a note of the author inserted in the *Comptes Rendus*, Vol. XVI., page 322 (see the *Chemist*, Vol. IV, 1843, page 211), and this work having been sent for examination to a commission, I awaited the report of this commission to fix my opinion finally concerning the causes of the great difference which exists between M. Bouchardat's results and mine.

PRACTICAL POINT OF VIEW.

If we enter upon the industrial and commercial question, we must recognise that in the present conditions of price of ammoniacal salts and nitrate of soda in France, if account be taken of only a single crop, and with respect to the fertilisation of meadows, there is a loss of more than a third of the expense. In order that there might be no loss, when this culture is required, it would be necessary that *all or most of* the two-thirds of the fertilising action be exhausted, and that at least one-third be produced by after-grass or the crops of the following year.

It is generally admitted, in Flanders, that the second year half the manure remains in the soil when stable-dung is used. With respect to Flemish manure, it has been remarked that its fertilising action is almost entirely exhausted in the first year; the last result is explained if we consider that in Flemish manure the greater part of the fertilising principles are volatilised, and this circumstance makes me recommend agriculturists to add to this manure, before spreading it on the fields, plaster in powder, or salts which, by their decomposition, are susceptible of giving more fixity to the ammoniacal salt. This is a practice whose utility I have proved.

This great volatility of the fecundising principle does not exist in the employment of sulphate and muriate of ammonia, although

the decomposition of these salts should take place by the chalk which forms part of the vegetable earth.

It may be admitted that at the present price of sulphate of ammonia, we may, by employing it as manure, even in the cultivation of meadows, find in the increase of crops an equivalent for the sum expended; the expence would much more certainly be covered by the application of this manure to the cultivation of linseed, tobacco, cabbages, &c. &c.

On the other hand, it must not be forgotten that from the moment when the ammoniacal salts find certain *debouchés* in agriculture, they will be collected in greater quantity, and their price will considerably *fliclin*.

When the beneficial influence of ammoniacal products shall have been appreciated by agriculture, it is not in the state of purified salts that these products will be sold, but in the state of the crude product of the distillation of nitrogenous matters; and, to render these products less volatile, and thus to avoid the considerable losses which are produced in the employment of manures in general, the decomposition of the carbonate of ammonia will be operated by matters of little value, by plaster, by magmas of alum, &c. &c. Three years ago I made an application of this method to several hectares of meadow land; I decomposed the ammoniacal products resulting from the distillation of coal in the gas works, by the acid waters arising from the acidification of bones, and I thus obtained an economical solution of ammoniacal salt, which enabled me to obtain three or four crops of herbs in a year,* and at an expence which is infinitely less considerable than would be required by any other manure to arrive at the same result. This is an application to which I call the attention of agriculturists, manufacturers of chemical products, directors of gas works, &c. &c.

It will be seen, according to the results obtained by No. 5 of the foregoing table (See The Chemist, No. L, p. 74), that of all the experiments made, that gave the most remarkable results. By comparing the expense with the receipt, we arrive at the proportion of 100 to 340 of Flemish manure, which is without contradiction the most advantageous manure, when it is pure, gave a profit of only 69·32 per cent. of the sum expended.

Such a result is so much the more remarkable as it is produced by a single crop when the influence of the manure in question is manifested in a very visible manner during several years, and especially as it is produced by a culture which least easily admits of the employment of an expensive manure.

Finally, the results are not without interest in this point of view, that if nitrate of soda, which has been successfully employed in England, cannot, at its present price in France, constitute a profitable manure, it can be used only in extraordinary circumstances; this product may become of general use in countries where manures are rare and means of communication difficult, when the Government, in the interest of these localities, will suppress the duty imposed on nitrate of soda imported into France, and which amounts to 16 fr. 50 cent. per kilogramme.†

Now that the manufacture of saltpetre is nearly abandoned in France, in consequence of the *faculty* granted to saltpetre makers of confining themselves to converting into nitrate of potassa the nitrate of soda of Chili, and that the Government provides itself with a great portion of saltpetre from the Indies, this suppression of the import duty on nitrate of soda could not interfere with any existing manufacture.

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* In order to arrive at this last result, it is right to mow before flowering: the hay gathered is not so nourishing: it was given in the green state to horses and cows.

† In the experiment No. 4, if nitrate of soda, free of duty, had been used, instead of a loss of 43 f. 89 cent., there would have been a profit of 8 f. 83 cent. from the first crop of hay.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

MORE INTENDED SECESSIONS FROM THE PHARMACEUTICAL SOCIETY.

Letters announcing secessions from the Pharmaceutical Society are literally pouring in upon us, especially from the country, and all of these letters offer warm thanks for our espousal of the cause of the trade. That these thanks are gratifying to us, we openly avow; they fully compensate us for the hostility which our efforts have entailed

on us. From private information in our possession, we are able to state that, within a very short period, the position of the Society will be very considerably altered, unless some improvement in its management be speedily effected.

Want of space and some other reasons induce us to defer making use of our information; but our readers are requested to trust to our vigilance, and to our zeal in their cause, or they may REGRET it when TOO LATE.

The reader of these lines who may not have seen the articles on this subject published in the April, and several succeeding Numbers of THE CHEMIST, for 1843, is earnestly requested to *lose not an hour in doing so.*

Those who intend to secede from the Society will much oblige us by communicating to us their intention, *in strict confidence.*

THE PHARMACEUTICAL SOCIETY AND SUNDAY TRADING.

To the Editors of The Chemist.

GENTLEMEN,

I WAS, some short time ago, much amused at the pleasantry of the editor of the *Pharmaceutical Journal* in answering a question of one of his correspondents respecting the obliteration of marking ink; he tells his "Constant Reader," "where ignorance is bliss, 'tis folly to be wise."

Preferring, gentlemen, the medium of your journal for two reasons; first, because you *originally* and *alone* fought our battle, and endeavored, with much success, to bring our scattered and divided body together, in the most praiseworthy and disinterested manner; and secondly, because I have no ambition for the summary and extremely aristocratical facetiousness of our friend Mr. Jacob Bell, the subject for which I crave a page in your columns is one of importance—it is important to the whole trade, because it touches all of us more or less.

Reform is said to have been begun among us, and there is much meaning in the remark of Sir J. Graham, that he would "leave the chemists to reform themselves."

The heads and more wealthy of our body forming the council of the Pharmaceutical Society are desirous, I doubt not, to benefit us; but, gentlemen, while their Sunday trafficking exists in the shameful manner it does, the more thinking amongst us know full well we shall not receive the benefit we should have from them. We live, move, and have our being from the Almighty Creator of the universe. We all (I hope) worship him; and that Almighty Being has distinctly said, "Reverence my Sabbath, and keep it holy." How is the sabbath revered in the drug trade? by selling, I fear, as much as can be sold.

On the Sunday—Go, from Temple-bar, by west, by east, by north, by south—each chemist's shop is open to the purchaser for any article he may want; visit other towns of importance on this day, and, alas! it is the same; your country chemist also must have his shop door open. I feel convinced, gentlemen, that nothing but the quiet and orderly deportment generally found in the chemist and druggist of Great Britain has kept him from figuring in the police columns as a common Sabbath Trader. But, however, to the point; it is a crying evil among us, it is against the law alike of God and man, and the remedy should commence at home, with the Council of the Society. The Council of the Pharmaceutical Society should not only recommend but *insist* upon the members throwing off this nefarious system of ungodly gains: until this is done, individually, first and forthwith by the council of our society, what blessing or what permanent benefit can we expect to emanate from a quarter where the very leaders morally set the laws of God and their country at defiance?

I have the honor to be,
Gentlemen,
Your obedient servant,
A COUNTRY M.P.S.G.B.

February 2, 1844.

INFLUENCE OF FLOWERS ON HEALTH.

To the Editors of The Chemist.

GENTLEMEN,

IN your last number I observed a brief article "on the influence of flowers on health," and having, during a long practice, paid some attention to this subject, I presume that a few remarks may prove interesting to the general, as well as professional reader.

The disease in which I have remarked flowers to exert the most decided influence

is asthma, and the following I have repeatedly noticed as invariably producing more or less distress and inconvenience, whenever the patient was exposed to their influence, on some occasions even only for a few minutes:—lilac, heliotrope, carnation, mignonette, white lilies, sweet brier, roses, and otto of roses, have each in turn produced aggravation of the asthmatic paroxysm, and in some instances induced it. Flowers, though very beautiful, and always engaging objects, should ever be placed with great caution in the rooms of the delicate or the invalid; and when such is the case, ought never to be permitted to remain for any length of time, and should by no means whatever be introduced into the sleeping apartments. Flowers and plants give out oxygen, and absorb carbon during the day, and by night they inhale oxygen and evolve carbon.

Ipecacuhana seems to be capable of exerting great influence over asthmatics, likewise on those who have a tendency to consumption or bronchitis, in a few instances beneficial, but generally the reverse; many of your readers will, perhaps, be sceptical on this subject,—nevertheless, it is a fact, and derived from long practice and experience.

Linnæus informs us, and he is no mean authority, that "Roses and briony in flower, walnut, elder (and colocynth when powdering), have produced faintness, and that those who have reposed under an elder or walnut tree have experienced, on waking, severe head-ache." Violets in large quantities will induce similar effects.

It was not long since that, when driving a friend in an open carriage through a lane, on both sides of which were fields covered with the red poppy, that he was rendered irresistibly somnolent; and, when he awoke, experienced nausea and faintness, resembling the effects induced by an overdose of opium.

There are several singular and well-authenticated accounts on record of an asthmatic affection, termed the hay fever. Persons generally get an attack on approaching a field of newly-mown hay, or on being exposed to a stream of air which is impregnated with the aroma from it. The effects are: sneezing, running at the nose, with great difficulty of breathing—in a word, it is a paroxysm of spasmodic asthma. The malady (if I may be permitted so to term it) is common, with such as are predisposed to it, during the hay season; and a similar inconvenience is experienced, only in a more limited degree, when packing a fresh-cut hayrick, or using it for other purposes. In every case of asthma, in which the individual has been affected by the influence of vegetable aroma, I have found the inhalation of medicated vapor invariably suspend the paroxysm, and in some cases have effected cures by these means alone.

I am, Gentlemen,
Your obedient servant,
W. Hamilton Kittoe, M.D.

25, Thayer-street, Manchester-square,
16th Feb., 1844.

EXPERIMENTS ON TEAS TURNED GREEN BY FOREIGN SUBSTANCES.

To Monsieur Chevallier, Member of the Council of Health, &c., Paris.

BY M. EUGE'NE MARCHAND, PHARMACIEN OF THE CIVIL HOSPITAL OF FECAMP.

Sir,—

I hasten to reply to your letter of the 29th of October last. In the course of last October, Mademoiselle de Saint-G., and one of her young relations, having experienced intolerable pains in the stomach and intestines, requested me to analyse a small quantity of tea which she sent to me. For about six weeks these two persons used this tea, which Mademoiselle Saint-G. had procured from a grocer of the town, and she regarded it as the primary cause of their indisposition.

Some days previously, the journals of Paris had noticed the introduction into commerce of some tea procured from the wreck, on the coast of La Mancha, of the English ship *The Reliance*. This tea, it was said, had been restored to color by means of a mixture of chromate of lead and plumbagine.

Being acquainted with these facts, I directed my investigations in such a manner as to be able promptly and surely to ascertain whether the tea submitted to my examination did not contain the first of these two substances, or another mineral substance injurious to health. My experiments positively demonstrated that it contained chromate of lead. I then informed the municipal authorities of it, who immediately sent for examination to a commission, appointed *ad hoc*, and composed of two of my colleagues, MM. Paquier, and Conillard, and myself, sixty-four samples of tea, procured from the grocers of Fécamp.

The process of analysis which I had at first put in practice with the tea of Mademoiselle Saint-G., was followed in the examination of the sixty-four samples, but, as it is described in the report, which my colleagues and myself made to the authorities, and which I adjoin to this letter, I will confine myself to

describing here only the specific characters of this tea.

It was still aromatic. At first sight, it presented the characters of Hyson tea of good quality, but on examining it with more attention, it was perceived, at least in most of the samples, that at least one-third of the leaves were less completely rolled than the other two-thirds. Some leaves were remarked, here and there, plaited and rumpled, but not rolled. There was also observed, in the whole of the mixture, a very large proportion of tea seeds, as well as a more considerable quantity of stalks and remains of leaves than in the good sorts of commerce. The color of these teas was very natural; however, it was, in general, of a black-blue, verging on green. At other times, the tea was colored of a fawn brown, or presented the appearance of a mixture of greenish-yellow, blackish-blue, and black leaves.

Before concluding this letter, I wish to call your attention to the very remarkable fact, that in all our analyses we found a small portion of iron in the teas submitted to our examination. The black teas contained a more considerable proportion than the others, and I intend, hereafter, to return to their chemical study, which, if I am not mistaken, may throw some light on the manipulations which teas undergo in China, or in the Indies, before being sold in European commerce.

If you find, Sir, that this letter and the following report present any interest, I beg you to be kind enough to insert them in the *Journal de Chemie Médicale*.

Agréez, &c.,
EUGENE MARCHAND.

REPORT ON THE ANALYSES OF SIXTY-FOUR SAMPLES OF TEA.

At the request of M. Banse, commissary of police in the town of Fécamp, we, the undersigned, Marie Benoni Couillard, Jean Eugéne Augustin Marchand, and Gabriel Adolph Paquier, pharmaciens of the Special School of Paris, at Fécamp, met in the offices of the Mayoralty of this city, on Friday, the 27th of October, 1843, there to receive from the hands of the Commissary of Police sixty-four samples of tea, numbered in order, and in which the existence of poisonous substances or substances injurious to health was suspected.

These samples having been given to us for chemical analysis, after we had been sworn to acquit ourselves well and conscientiously of the duty confided to us, we repaired to the chemical laboratory of one of us, M. Marchaud, and there we proceeded to the examination in the following manner :—

Chemical Examination of the different Samples of Tea.

We put a certain quantity of each sample in contact, for twenty or thirty minutes, with its own bulk of pure and concentrated nitric acid. After this time the liquor was diluted with water, decanted, and filtered. The leaves, thus exhausted, were also several times submitted to successive washings in pure water—then raised to the boiling temperature, in order to be put in contact with hydrosulphate of soda. All the samples gave, in these circumstances, a black, flocculent precipitate, sometimes scarcely perceptible—at other times, on the contrary, very considerable. Each of these precipitates was collected on a filter, carefully washed, dried, and then incinerated.

The teas which we examined may, *from the nature of these precipitates*, be divided in two series. In the first are those whose precipitates, after having been incinerated, left a residue which, re-dissolved by a dilute acid —nitric acid for example—furnished a liquor which, being endowed with only a very slightly acid reaction to litmus paper, did not give rise to the formation of a black precipitate when it was submitted to the action of a current of sulphuretted hydrogen.

The metal which is contained in these teas, and which hydrosulphate of soda thus precipitates under the form of black flocks, is *iron*; for these precipitates are soluble in weak acids, and their solution, submitted to the action of reagents, gives rise to the following phenomena :—

With ferrocyanuret of potassium, a blue precipitate.

With sulphocyanuret of potassium, a blood-red coloration.

With tincture of galls, a black coloration.

With ammonia, a flocculent and yellowish precipitate.

With sulphate of soda, no sensible reaction, even after twenty-four hours' contact.

The samples of tea which belong to this series are designated by the numbers 3, 4, 5 6, 7, 8, 10, 11, 13, 14, 16, 18, 20, 21, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 38, 40, 42, 43, 47, 48, 49, 51, 52, 53, 54, 55, 56, 57, 58, 60, 62.

The teas which belong to the second series, are those whose black precipitates incinerated and redissolved in dilute nitric acid, furnish a liquor which, evaporated to dryness in order to drive off the excess of acid, leaves as a residue a saline mass, which is only partially soluble in pure distilled water; there remains a small quantity of a white powder, which becomes black under the influence of the alkaline hydro-sulphurets. The aqueous solution, submitted in its turn

to the action of sulphuretted hydrogen, deposits a black precipitate. We every time collected this precipitate, in order to submit it to the following experiments :—

We subjected a small quantity of it to the action of the blowpipe, and to the reduction fire, with borate of soda, in a small Le Bailif's capsule. By this operation, when the quantity of sulphuret employed was sufficient, we always obtained metallic globules, quite visible to the naked eye or with the microscope. By continuing to heat before the blowpipe, but at the extremity of the oxidising flame, the metal disappeared, and we obtained an enamel which remained yellow so long as it was hot, but which became colorless on cooling.

This black precipitate, being redissolved in nitric acid, produced a liquor which, being neutralised as accurately as possible, and submitted to the action of the following reagents, gave rise to the phenomena which we now describe :—

With sulphate of soda, a white precipitate, soluble in potassa, and turning black with the alkaline hydrosulphates.

With ammonia, a white flocculent precipitate.

With carbonate of potassa, a white precipitate.

With oxalate of ammonia, a white precipitate.

With bichromate of potassa, a yellow precipitate, insoluble in dilute acid, but soluble in potassa.

With iodide of potassa, a yellow precipitate, soluble in an excess of the reagent.

These experiments prove, in a positive manner, that the black precipitate obtained under the influen e of sulphuretted hydrogen was sulphuret of lead.

The liquor, from which the sulphuretted hydrogen separated this sulphuret, being saturated by ammonia, also furnished a black precipitate with the alkaline hydrosulphates, and the precipitate, collected on a filter, washed and dried, then submitted to the action of the blowpipe, with borax and a little nitrate of potassa, gave rise to a matter which swelled up and which was of a *green color*, a certain indication of the presence of chrome in this matter. By some other experiments, it was always easy also to detect the presence of iron in this precipitate.

From all these experiments, we must conclude that the black precipitates, from this second series of teas, under the influence of the alkaline hydrosulphates, were composed of sulphurets of iron, lead, and chromium, and the teas which furnished them to us are designated by the numbers 1, 2, 9, 12, 15, 17, 19, 22, 26, 36, 37, 39, 41, 44, 45, 46, 50, 59, 61, 63, and 64.

CONCLUSIONS.

From all the foregoing experiments, it evidently follows that the sixty-four samples of tea submitted to examination contained a small quantity of iron; but, as this iron can in no case be injurious to health, we declare that all the samples of tea belonging to the *first series*, and which contain only this metal, exclusive of every other, may be sold for consumption without any inconvenience.

It is not the same with the teas of the *second series*, which contain, in variable proportions, a salt of lead, the chromate, which may communicate to them injurious properties. The continued use of these teas might give rise to unpleasant symptoms, analogous to those to which painters are subject, and which are ordinarily designated by the name of painters' colic.

These teas contain variable proportions of chromate of lead: they consist, for the most part, of mixtures of leaves of inferior quality with others of a better quality ; and, besides, its coloring could not be effected with sufficient accuracy for the coloring matter employed by the adulterator to be uniformly spread throughout the mass of the tea.

Be it as it may, the following is the order in which these teas should be ranked, with regard to the proportion of lead which they furnished to us, and commencing with those which contain most of it:—64, 1, 22, 39, 45, 46, 59, 61, 63, 9, 26, 50, 2, 12, 36, 37, 41, 15, 44, 17, and 19.

B. Couillard.
Eugene Marchand.
Paquier.

Fécamp, November 14, 1843.

ADULTERATION OF WINES.—PROCESS FOR DETECTING IN WINE THE PRESENCE OF FOREIGN COLORING MATTERS.*

BY M. JACOB, OF TONNERRE.

In a note which I had the honor of address- to you a few days ago, I made you acquainted with some experiments which I have tried with the view of ascertaining whether a wine was colored by berries of wall-wort, or by litmus.

Subacetate of lead gave, with the first of these substances, so decided a reaction, that I considered myself authorised in regarding this sophistication as henceforth impossible, from the facility with which it might be discovered ; two subsequent experiments having demonstrated that that which I considered an

* *Journal de Chemie Médicale*, Feb. 1844.

infallible and fixed character diminished in importance, and even completely disappeared, when, instead of acting on the recent juice of the berries of wall-wort, a juice in fermentation, or entirely fermented, were operated on; I necessarily occupied myself with seeking for another means which might enable us to recognise this adulteration in both these cases. I think I have attained this object by employing, concurrently, subacetate of lead on one hand, and sulphate of alumina and carbonate of ammonia on the other.

In a paper on the wines of Tonnerre, inserted in the September number of your journal, I pointed out how we might, by means of sulphate of alumina and carbonate of ammonia, detect in a wine the coloration produced by the petals of wild poppy, Indian wood, and wood of Fernambouc; I said that the reactions were so decided, that it was impossible to be mistaken concerning the nature of the precipitate produced by this reagent. I added, but as an assumption, that the other coloring matters which are employed in the adulteration of wines, should give different colorations, which would serve to distinguish them. I promised to devote myself to this subject at a convenient opportunity; experience having confirmed a portion of my anticipations, I now fulfil my promise, by sending to you the result of my numerous experiments on these substances.

Although I have already indicated the coloration of the precipitates furnished by the petals of wild poppy, Indian wood, and wood of Fernambouc, I think it right here to include them in a table with the other coloring matters, in order that the different colorations which characterise each of these substances, may be more easily appreciated.

TABLE OF THE COLORATIONS OBTAINED BY SULPHATE OF ALUMINA AND CARBONATE OF AMMONIA WITH THE COLORING MATTER OF WINES ADULTERATED WITH THE PETALS OF WILD POPPY, INDIAN WOOD, WOOD OF FERNAMBOUC, BERRIES OF WALL-WORT OF PRIVET, AND LITMUS.

Natural wine,		Greyish precipitate.
Id.	Indian wood,	Deep violet precipitate.
Id.	Fernambouc,	Rose-pink precipitate.
Id.	Wild poppy,	Slate-colored precipitate.
Id.	Berries of wall-wort,	Light violet precipitate.
Id.	Elder,	Bluish-grey precipitate.
Id.	Privet,	Light green, copperas-green precipitate.
Id.	Litmus,	Rose-pink precipitate.

It is easy to see from this table, that several of these precipitates are so similar that it would be very difficult to give an opinion concerning their nature, if another reagent did not aid in solving the problem. The subacetate of lead may be successfully employed in all cases in which sulphate of alumina and carbonate of ammonia are incapable of detecting the fraud; it gives with these substances various colored precipitates, which do not admit of mistake.

Thus, Indian wood and berries of wall-wort which seem to be confused in the reaction of sulphate of alumina and carbonate of ammonia, present, on the contrary, decided differences under the influence of a few drops of subacetate of lead.

Litmus and wood of Fernambouc, both of which give a rose precipitate, assume a different coloration by the same reagent.

I should add, however, that a small quantity of litmus added to a natural red wine, of which it is wished to heighten the color, is insensible to the action of sulphate of alumina and carbonate of ammonia; and that, in this case, recourse must be had to the evaporation of the wine to the consistence of an extract, a very small quantity of which is afterwards dissolved in a little distilled water, in order to be treated as above.

TABLE OF THE COLORATIONS OBTAINED BY SUBACETATE OF LEAD WITH THE COLORING MATTER OF WINES ADULTERATED AS ABOVE.

Natural wine,		Bluish-grey precipitate.
Id.	Indian wood,	Rather deep blue precipitate.
Id.	Fernambouc,	Vinous-red precipitate.
Id.	Wild poppies,	Dirty grey precipitate.
Id.	Recent juice of wall-wort,	Bluish-grey precipitate, due to the natural coloring matter of the wine, supernatant liquid of a fine violet color.
Id.	Fermented juice of wall wort,	Fine diapered-green precipitate.
Id.	Elder berries,	Dirty-light green precipitate.
Id.	Privet berries,	Idem.
Id.	Litmus,	Bluish-grey precipitate.

From these characters it may be concluded :—

1. That a wine can no longer be artificially colored, without it being possible immediately to deteet this fraud.

2. That sulphate of alumina and earbonate of ammonia, employed as I have directed, may serve for the recognition of most of the coloring matters which serve for adulterating wines.

3. That subacetate of lead may also be sueeessfully employed in the same eireumstances, espeeially when the eharaeters furnished by the former reagents are not sufficiently decided.

4. That it is very easy to aseertain, by means of this reagent, whether the violet precipitate obtained in a wine by sulphate of alumina and carbonate of ammonia, is due to the presenee of the berries of wall-wort and Indian wood : in the first case, there is obtained, by subacetate of lead, a magnificent green precipitate, or a bluish-grey precipitate, with a violet coloration of the supernatant liquid, aceording as the juice of wall-wort employed is reeent or fermented ; that, in the second, a rather deep blue precipitate is constantly obtained with the same reagents.

5. That it is the same with litmus or wood of Fernambouc, in which sulphate of alumina and carbonate of ammonia form a rose precipitate, but which act differently under the influenee of subacetate of lead ; with litmus a greyish-blue precipitate is formed, and with wood of Fernambouc, a vinous-red precipitate.

IV. REVIEWS AND NOTICES OF BOOKS.

A MANUAL OF ELECTRICITY, MAGNETISM AND METEOROLOGY.

By Dionysius Lardner, D.C.L., F.R.S., &c. &c., and Charles V. Walker, Seeretary to the Electrieal Soeiety. In two volumes. Vol. II. London : Longman and Co. 1844. pp. 550.

We have not before us the first volume of this work ; therefore we can give no opinion as to the treatise as a whole ; but, judging from the volume before us, we regard it as a most exeellent elementary treatise.

It was commeneed by Dr. Lardner, and forms the 131st volume of "The Cabinet Cyelopædia," and was diseontinued by Dr. L. owing to circumstances well known to the public. Consïderable delay in its publication was the result; but the publishers, to whom it is but just to mention no blame attaehes in the matter, finally made arrangements for its completion with Mr. C. V. Walker, the talented editor of "The Electrieal Magazine," who has fulfilled his very difficult task with admirable skill.

Book I. continues "Electro-statics" from Vol. I. Book II. treats of "Atmospheric Electrieity ;" Book III. of "Voltaie Electricity ;" Book IV. of "Magnetism ;" Book V. of "Electro-Magnetism ;" Book VI. of "Magneto-Electric Induetion ;" and Book VII. of "Thermo Eleetrieity."

We regret that it is not in our power to give more complete analyses of this excellent manual : suffice it, therefore, to say, that it is eminently adapted for all who wish to acquire a complete knowledge of the science of which it treats, and that it is written in a style ealculated to render its instruction pleasing.

We subjoin an extraet on a branch of electrieity likely to interest our readers.

ON THE ELECTRICITY EVOLVED BY THE FRICTION OF WATER AND STEAM AGAINST OTHER BODIES.

One day, in the autumn of 1840, a workman at Sighill, near Newcastle, aecidentally plaeed one of his hands in a jet of steam whieh was issuing from a fissure in some eement of chalk and oil plaeed around a safety-valve of a steam-boiler, his other hand being at the time adjusting the weight on the lever ; and he was greatly surprised at perceiving a spark, and receiving a smart electrical shoek. Mr. Armstrong, of Newcastle, a gentleman attaehed to scienee, saw in a moment that this fact was the first fruits of a new line of research, whieh was well worthy of pursuit, and he spared no pains in following it out.

He found the boiler built in masonry : antecedently to his arrival, it had been cleaned from a deposit of calcareous matter, which had been hollowed by a great reduction of electrie effects. About a week afterwards the incrustation had been regained, and the eleetric effeets were inereased. He attached a wire, having a metal plate at one end and a brass ball at the other, to an insulating handle, and on plaeing the plate on a jet of steam, and the ball within a quarter of an inch of the boiler, he obtained 60 or 70 sparks per minute : he also readily charged a Leyden jar. The pressure of the steam at first was 35lb. ; and, as it diminished, the electric action also diminished. He found the electricity of the *steam* to be *positive*. He could

find no indications of electricity about the boiler, which was, indeed, in connection with the earth, and this, as we shall presently see, was the reason of its appearing neutral. He tried another boiler at Sighill, which, as well as the preceding, was supplied with *well water*, and succeeded in obtaining similar effects. On failing to obtain electricity from a third boiler, supplied with *pure water*, he inferred that the phenomena were partly due to the *nature of the water*, which, in the former case, contained sulphate of lime, oxide of iron, and insoluble argillaceous matter. Professor Faraday, in a note to the above, conceives that the phenomena might be due to an exaltation of the known effects of evaporation—those of which mention is made hereafter.

Mr. Armstrong subsequently went through a regular series of experiments, in order to determine the situation at which the vapor first commenced being electrized; whether it is so *in the boiler*, or becomes so during its passage *through the orifice*, or only when it escapes *into the air*. Before commencing the experiments, he blew off some steam through a stop-cock *close* to the boiler, and obtained no electrical effects, which was proof sufficient that they are not due, as he at first thought, to the *character of the water* in the boiler; for, in this case, it was the same well water as that previously employed. His arrangement for determining the locality of electrization was this:—He affixed to the above-mentioned stop-cock a glass tube, having a stop-cock at the extremity, and another in the interval. On opening all three, the intermediate one gave no signs of electricity, whilst the upper one was highly *positive;* whence it appeared to him probable that the electricity was not developed until the *escape of the vapor into the air*. But he felt it difficult to account for the absence of *negative* electricity, unless the extreme supposition were taken, that the condensation which takes place in the jet sets at liberty the electricity which the vapor had absorbed during its formation. He proved, however, that the vapor, when *in the boiler*, contained no free electricity, by introducing a metal point through the intermediate stop-cock, and then closing the latter to prevent the escape of steam; for, under these circumstances, the metal gave no electrical indications.

Mr. H. Pattinson describes the result of some experiments he made with locomotive engines on the Newcastle and Carlisle Railway, to which he was led by Mr. Armstrong's discovery. In order to collect the electricity from the steam, he employed, first, a wire terminating in many points, and then a hollow truncated zinc cone, interlaced with copper wire, and furnished with a great number of points. The cone was three feet high, and its base three feet in diameter. He obtained sparks three or four inches long, and by the latter of the two arrangements he increased the *volume* of each spark, but not its length. He succeeded in *insulating* the locomotive on blocks of wood; and then was the first to find, that while the steam was charged with *positive*, the boiler was highly charged with *negative* electricity. The inference he drew from his various experiments was the same as that suggested in Faraday's note, viz., that this liberation of electricity during vaporisation is the same as that with which philosophers were already familiar, but on a much less extended scale. It appeared to him that the electricity was generated at the *moment* of *vaporisation;* but he felt that this theory did not account for the variations of intensity, and the difference of intensity observed with boilers under the same pressure. He was induced to think it probable that a chemical action between the metal and the water exalts the electrical condition of the newly-formed vapor. In reference to this, he notices that boilers having copper tubes give the greatest electrical effects. He concludes with remarking how curious a fact it is that locomotive machines are transformed into enormous electric machines, in which the *vapor* corresponds to the *glass plate* of a common machine, and the *boiler* to the *cushions;* and in this observation he unconsciously publishes the elements of *the true theory*, which, as will be seen in the sequel, was afterwards developed by Faraday.

Mr. Armstrong, also, on continuing his experiments, insulated the boiler, and obtained no effects until the jet was opened, when the boiler was highly *negative*, and the *positive* state of the steam had certainly diminished in quantity. He found, also, that there was more electricity when the stop-cock was *partially closed* than when it was entirely open. He now was of opinion, that in proportion as the steam forms in the boiler, it *absorbs electricity* from neighboring bodies, in order to obtain the neutral state, and that when, by condensation, this vapor returns to water, the electricity thus absorbed becomes free, and hence the positive electricity found in the jets; and that, if the boiler is insulated, it, as well as the uncondensed vapor contained in it, is negative, provided the vapor can escape, but not otherwise; for, if the steam is retained in the boiler, the evaporation will not be attended with any *increase* of *volume*, and hence *absorption* of electricity cannot take place: whereas, when water is converted

into vapor, its *capacity* is so altered that it seemed to him rational to suppose that the quantity of electricity sufficient for rendering it neutral cannot be the same under the same forms. He felt one serious objection to this theory, in the fact of its assuming that the boiler is *negative* independently of the *condensation* of the steam; and hence, if the exit of the steam be viewed exclusive of its condensation, there will be a development of *negative* electricity without an equivalent of positive.

M. Schafthœutl describes experiments which he undertook (on finding scarcely any appreciable signs of electricity from a Perkins's boiler, under pressure of 40 atmospheres) in order to determine whether this neutral effect were due to the absence of deposit in the boiler. He is the first to notice that the success of the experiments appears essentially to depend on the quantity of *water, in every minute division*, which the steam carries out *with it*, which favorable circumstance is indicated by a peculiar noise; but he infers that the positive electricity is due to the condensation of the vapor and the separation of the resulting water, and not to *friction*. He had suspected friction might occur in the *bell-glass* wherein he condensed the steam: he, therefore, inverted the bell; and, having placed some water in it, he allowed the steam to flow on the water, where condensation occurred, without friction, and electric effects were produced. He found, also, that distilled water, solution of common salt, or solution of sulphate of lime, under similar circumstances, produced the same amount of electricity. Mr. J. Williams, in the *Phil. Mag.* for Feb. 1841, states, that in 1838, on observing the repulsive character of the particles of steam, he thought them electrical; and that, on insulating the vessel in which the steam was formed, he found it decidedly negative when steam was blown off at high pressure. He does not appear to have followed out this idea.

Pursuing his opinion of the development of electricity being due to change of capacity, Mr. Armstrong examined the condition of jets of air liberated under a high pressure, which he had condensed in a strong vessel to the amount of eighty atmospheres. He found these jets, like those of steam, to be highly *positive*, while the vessel was generally *negative*, and sometimes furnished sparks a quarter of an inch long. The vessel was occasionally *positive*: this being the first indication of an anomalous effect often manifested in future experiments, and ultimately investigated by Faraday. He succeeded better in *cold* and *moist* weather than *warm* and *dry*; and this tended to strengthen his opinion in favor of *condensation*.

M. Peltier gives the following observations on the electricity of evaporation as illustrating the earlier experiments of Armstrong and of Pattinson. 1. If a drop of pure water is placed in a red-hot platinum capsule, it undergoes certain tumultuous and giratory motions, during which the platinum remains dry; it then flattens out, wets the capsule, and is at once dissipated in vapor; but *no electrical* effects take place. 2. The same phenomena attend a weak solution of common salt, with the exception that it leaves behind it an incrustation of salt. 3. But when the incrustation is dissolved, by adding a second drop of the solution of salt, the water, thus more highly saturated, is generally reduced in quantity; certain decrepitations succeed, attended by saline projections, and, *simultaneously with them*, negative electricity is developed. If the platinum is now cold enough to allow of being wetted, the liquid goes off *in vapor*, but with *no* electric effect. 4. The same occurs when salts themselves are used instead of solutions. The electricity, in these cases, is not produced when the super-abundant water is being separated, but at the moment when a, *chemical decomposition* takes place, *i. e.*, when the molecules of water of crystallisation are released from combination. Whence he inferred, that to produce the effects observed by Mr. Armstrong, water saturated to the point of *affording a deposit* was necessary; also a high temperature; and that the electricity increases with the deposit, and varies with the temperature. He subsequently modified these views; and in a communication made to the Philomatic Society, January 2, 1841, after alluding to the production of electricity from the vapor of *pure water* in a copper boiler, under high pressure, which, with previous philosophers, he found *positive*, while the boiler was *negative*, he says, that the quality of the water, the pressure, *the form and material of the appendage forming the orifice*, vary the tension and the *nature* of the electricity.

M. de la Rive was of opinion that thus far the various experiments had by no means established the cause whence so abundant a development of the electricity of tension originated. Many of the experiments were in favor of vaporisation, and in this respect the solution of the question had been approached, but not attained.

Mr. Armstrong pursued his inquiries, and besides confirming the parts relative to condensed air, he found that when the air was *dried* by the presence of potassa, almost the same effects occurred. It is fit to mention that the weather at the time was mild and *damp*. He found, on the other hand, that if the vessel were made very dry by heat, no effects were produced. He noticed a peculiar

noise attending some of the successful experiments, which appeared to correspond with that heard by Schafthœutl.

He had, by this time, at his command a boiler (*fig.* 99 *a*) constructed for the special

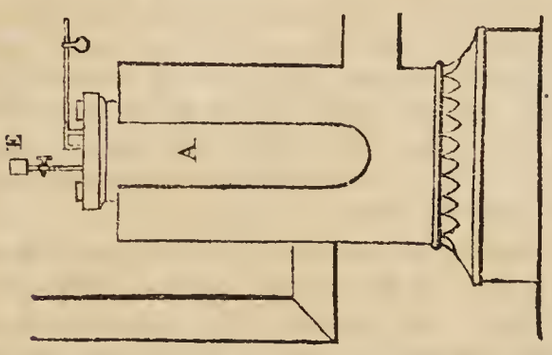


Fig. 99 *a.*

purpose of investigation. It was made of gun-metal, an alloy of copper and tin; was of cylindrical form, thirty in. by four in.; could be used with safety to 250lbs. pressure per square inch, and was mounted on glass legs. A copper tube, proceeding from the top of the boiler, entered the furnace, and, after several coils, emerged laterally, when it was terminated by a stop-cock. This tube was for *drying* the steam. It could be removed at pleasure. In the course of experiments with this instrument, he discovered, with surprise, that the steam in some cases was *negatively* electrised, and the boiler *positively*. The only clue he could then obtain towards unravelling this mystery, which so overthrew his previous theories, was, that when the temperature of the upper part of the boiler was *very greatly elevated*, the change occurred; but he suspected there were other causes present. When he allowed the steam to escape *en masse* out of the safety-valve, no electrical effects were obtained. On trying comparative effects of steam at different pressures with 3lbs., he obtained five or six sparks per minute; he doubled this with 15lbs.; tripled it with 50lbs.; quadrupled it with 120lbs., and not more than quintupled with 250lbs. He does not appear to have been able to classify the various anomalies presented by the change of electric state; but he remarks that he has often obtained a *negative* jet from the tube, while a *positive* jet escaped from the safety-valve. By allowing the vapor to expand without condensing, by means of a *hot* metal cylinder affixed to the tube, he found that the steam, which passed on, was as much electrised as before; and hence he inferred *dilatation* was not the cause. Putting out of the question other causes, which were not influential, there appeared to him nothing left but to attribute it to the *precipitation of the vapor;* and he appears to trace the opposite condition of the boiler to the influence —the *inductive* influence apparently—of the electricity of the precipitated vapor; but he feels the difficulty of his position from the fact, that the electricity of the boiler appears altogether independent of the *proximity* of the jet.

Finding that the *negative* tendency of the jet increased as the boiler was used, he was induced to wash the boiler first with water, which did not, then with potassa, which did restore it to its primitive condition. Soda acted like potassa: a little nitric acid in the water made the vapors negative; hydrochloric had no effect, nor had sulphuric, even when iron filings were introduced; lime made the vapor *positive;* common salt, no effect; nitrate of copper, *negative.*

The idea now occurred to Mr. Armstrong of taking advantage of this new source of electricity in a practical point of view; for he conceived that a vaporo-electric apparatus might be constructed to supply the place of the common machine. In pursuance of this idea, he constructed a boiler of forged iron (*fig.* 99 *b*), three feet long and twelve feet in diameter, with a series of steam jets, H. The rod B D and conductor C were subsequently added* at the suggestion of Captain Ibbetson.

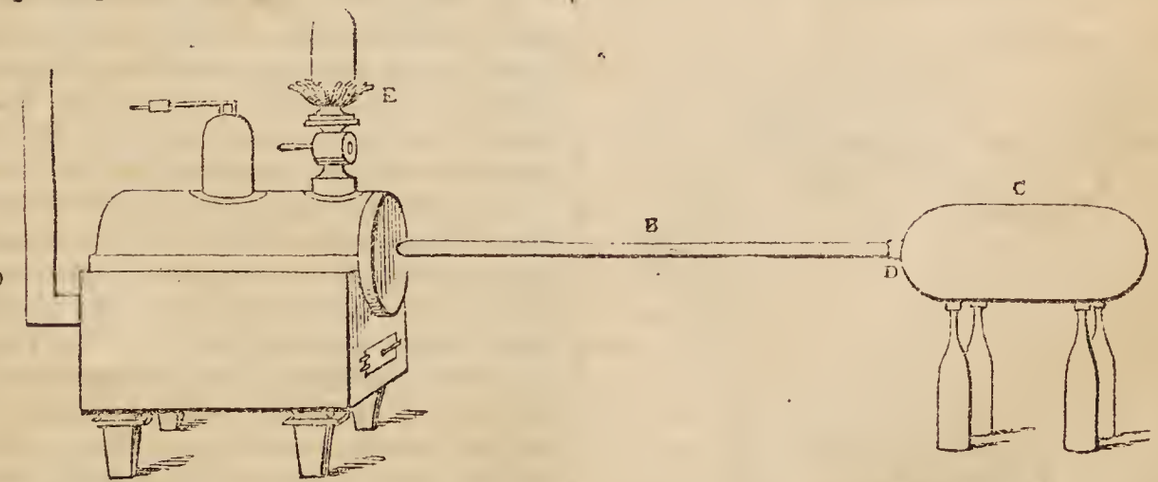


Fig. 99 *b.*

He had by this time discovered that the development of electricity takes place at the moment when the steam is subjected to *friction,* and that hard wood was the best material for it to rub against; and he also found it necessary that water be *mingled*

* Proceed. Elec. Soc., p. 527.

with the steam in order to produce remarkable effects; but he could not trace to *friction alone* the great development of electricity which here took place, for the apparatus was *seven* times more powerful than a large electrical machine, so that it would appear he attributed the effects at that time to the *joint influence of friction and condensation.*

In the interval between the publication of the last letters of Mr. Armstrong, Professor Faraday was engaged in a series of researches, the results of which clear up many of the difficulties that had heretofore presented themselves. His generating apparatus was an insulated boiler of the capacity of ten gallons, and he worked to two-fifths of our atmosphere.

At the outset, he satisfied himself that the electricity was neither due to *evaporation* nor *condensation;* for, if the valve were taken out, no electricity was manifested, though the evaporation was then very great: again, if the boiler was excited with resin, opening the valve produced no change. Moreover, he devised means, which will be mentioned presently, of making the boiler positive, negative, or neutral with the same steam, and therefore with the same evaporation.

Then he proved that *steam alone* is not sufficient. He attached to his boiler a horizontal tube, to which the "steam globe" (*fig.* 99 *c*) could be screwed: at the further side of the globe various forms of jet could be fixed (*fig* 99 *d*), which he terms the cone apparatus, and which is an admirable exciter. The following results are highly instructive:—

"If there be no water in the steam globe, upon opening the steam-cock, the *first effect* is very striking; a good excitement of electricity takes place, but it very soon ceases. This is due to water condensed in the cold passages, producing excitement by rubbing against them. Thus, if the passage be a stop-cock,

Fig. 99 *c.*

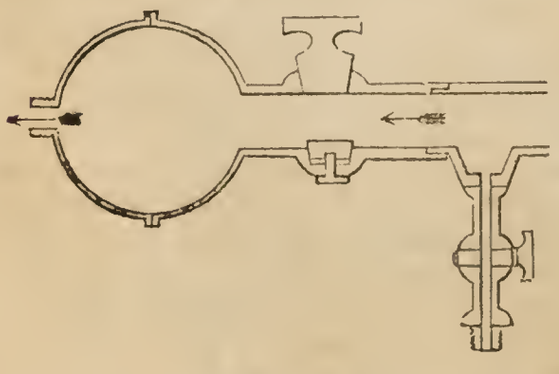
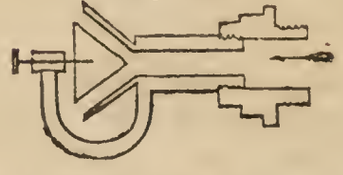


Fig. 99 *d.*



whilst cold it excites electricity with what is supposed to be steam only; but, as soon as it is hot, the electricity ceases to be evolved. If, then, whilst the steam is issuing, the cock be cooled by an insulated jet of water, it resumes its power. If, on the other hand, it be made hot by a spirit-lamp before the steam be let on, then there is *no* first effect. On this principle I have made an exciting passage by surrounding one part of an exit tube with a little cistern, and putting spirits of wine or water into it."

But the particles must be *pure water.* Distilled water in the globe produced the effect. The addition of common salt, sulphate of soda, nitre or sulphuric acid rendered the steam neutral; so did the common water of London. Potassa, or any substances which gave conducting power to water, destroyed its exciting power as effectually as moisture destroys the exciting power of flannel. Ammonia, which adds but little to the conduction of water, did not destroy the power; but sulphate of ammonia, produced by the further addition of a little acid, did.

The influence of the *rubbed* substances he next investigated by the successive employment of "cones of various substances, either insulated or not; and the following, namely, brass, box-wood, beech-wood, ivory, linen, kerseymere, white silk, sulphur, caoutchouc, oiled silk, japanned leather, melted caoutchouc and resin, all become negative, causing the stream of steam and water to become positive." The rubbed substances were likewise examined by placing them on insulating handles, and holding them in the jet. Of thirty substances thus tried, *all* were rendered negative, though not in the same degree; for instance, "quill and ivory had very feeble powers of exciting electricity, as compared to other bodies."

Mr. Faraday then alludes to the almost neutral effect of some bodies, especially ivory, already mentioned, and shows how it enabled him to test the series of substances, by furnishing him with a neutral jet. He then adverts to effects produced by a positive jet, "which, if not understood, would lead to great confusion"—that a wire-gauze, for instance, when in the jet *near the exit*, is rendered negative; because, as he explains, under such circumstances it is forcibly rubbed by the issuing stream; but if *further removed*, it is made positive, acting then only as a collector from the already excited stream; there is also a neutral point. These double effects do not occur with a neutral stream, from an ivory jet.

He adds—

"With dilute sulphuric acid in the steam-

globe, varying from extreme weakness to considerable sourness, I used tubes and cones of zinc, but could obtain *no trace* of electricity. Chemical action, therefore, appears to have nothing to do with the excitement of electricity by a current of steam.

The remarkable circumstance of water being *positive* to so many bodies, is then noticed; as also the probability that it may find its place above all other substances, even cats' hair and oxalate of lime.

The effect of oil of turpentine in producing *negative* electricity in the stream, and *positive* in the boiler, is next described.—"Hogslard, bees-wax, castor-oil, resin, applied dissolved in alcohol, these, with olive-oil, oil of turpentine, and oil of laurel, all rendered the boiler positive, and the issuing steam negative." Some substances give variable results; but it is easy to comprehend that, according as a substance may adhere to the body rubbed, or be carried off by the passing stream, exchanging its mechanical action from rubbed to rubber, it would give rise to variable effects. These effects of oil involve the necessity of attention being paid to the condition of the screws connected with the various passages; for the unsuspected presence of a little oil may mar the effect of every arrangement; and, perhaps, some such influence may have been present to produce a few of the contradictory results we have noticed.

The author then goes on to explain how the introduction of oil virtually converts the watery globules, so far as their rubbing surface is concerned, into oil globules, by forming a film on their surface; and this, too, explains the "fact that alkalined water, having no power of itself, should deeply injure the power of olive oil or resin, and hardly touch that of oil of turpentine; for the olive oil or resin would no longer form a film over it, but dissolve in it; on the contrary, the oil of turpentine would form its film."

Conceiving thus that steam, as such, was merely the mechanical agent to carry onward the rubbing particles, Mr. Faraday proceeded to experiment with compressed air, condensed into a strong copper box, which had been previously carefully cleaned from all traces of oil by caustic potassa; the average quantity of air which could be issued at each blast was 150 cubic inches. When common *undried* air was used, it rendered the cone negative exactly as the steam and water had done.

"This," as the author expresses it, "I attribute to the particles of water suddenly condensed from the expanding and cooled air rubbing against the metal or wood: such particles were very visible in the mist that appeared, and also by their effect of moistening the surface of the wood and metal. The electricity here excited, is quite consistent with that evolved by steam and water; but the idea of that being due to evaporation is a striking contrast with the actual condensation here.

When the same experiments were repeated with *dry* air (dried by having placed potassa fusa in the box), it was found quite *incapable* of exciting electricity, precisely as had been proved to be the case with *dry steam*. The introduction of water, saline, or acid solutions, or the oils, in the course of the stream of common air, produced exactly the same effects as if these substances had been carried forward in their course by steam."

A few experiments were tried, in conclusion, with the air current and dry powders. The results were somewhat irregular, from the very nature of the rubbing materials, for in some cases they adhered to the cones, and became the rubbed.

The memoir is terminated with the following deduction:—

"Finally, I may say that the cause of the the evolution of electricity by the liberation of confined steam is not evaporation; and, further, being, I believe, friction, it has no effect in producing, and is not connected with the general electricity of the atmosphere. Also, that as far as I have been able to proceed, pure gases, *i. e.*, gases not mingled with solid or liquid particles, do not excite electricity by friction against solid or liquid substances."

Several of the elements of this theory, as our readers have seen, had presented themselves to other philosophers; but until Mr. Faraday had investigated the subject, their connection had not been clearly developed; nor had those actions, which have no influence in the ultimate effect, been distinctly defined.

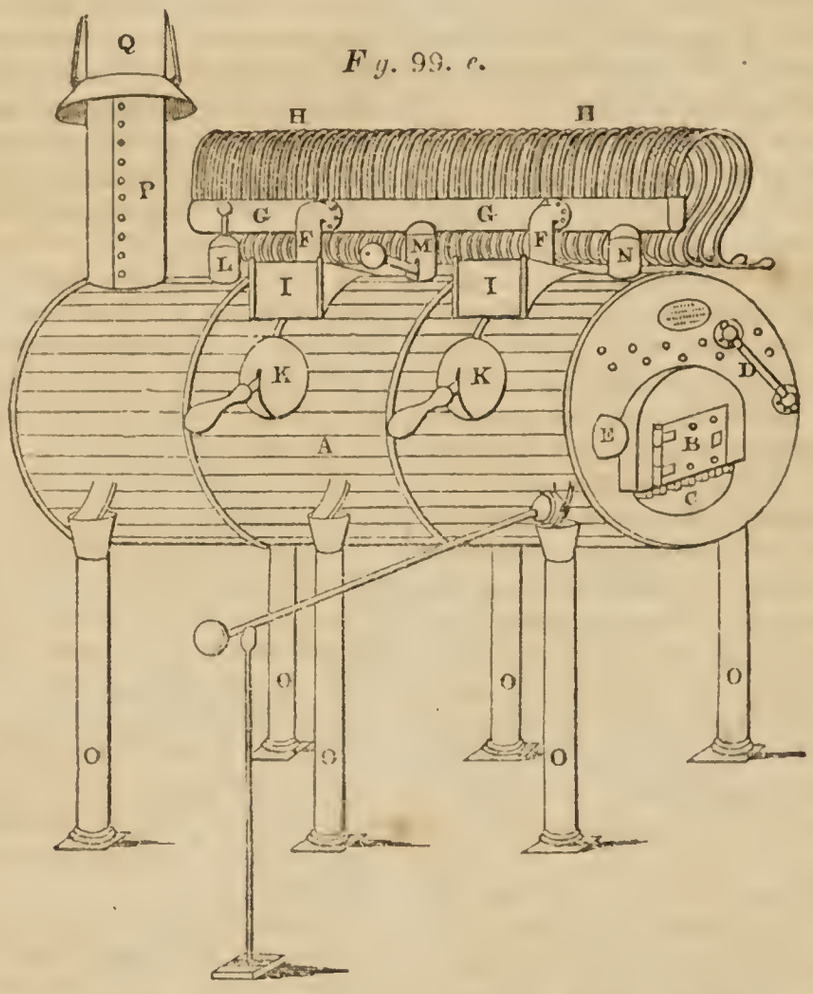
We extract the following description of Armstrong's Hydro-Electric Machine, for the benefit, more especially, of our provincial readers:—

ARMSTRONG'S HYDRO-ELECTRIC MACHINE.

Fig. 99 *e* represents the machine. A is a cylindrical tubular boiler of rolled iron-plate; its extreme length is seven feet six inches, one foot of which is occupied by the smoke chamber, making the actual length of the boiler six and a half feet: its diameter is three and a half feet. The furnace B and the ash-hole C are contained within the boiler, and are furnished with a metal screen to be applied for the purpose of excluding the light during the progress of one class of experiments. D is the water gauge. E the feed valve. F F two tubes leading from the valves I I to the two tubes G G. H H are forty-six bent iron tubes, terminating in jets; either half, or the whole, of which may be

opened by means of the levers K K. L is a valve for liberating steam during the existence of the maximum pressure. M is the safety valve; N is a cap covering a jet, that is employed for illustrating a certain mechanical action of a jet of steam. O O, &c., are six stout pillars of green bottle glass, by means of which the boiler is insulated at three feet from the ground. P is the first portion of the funnel, Q the second portion, which slides into itself by a telescope joint, so that the boiler may be insulated when the experi-

Fig. 99. *e.*



ments commence. The boiler is cased in wood to reduce radiation of heat. *Fig.* 99 *f*

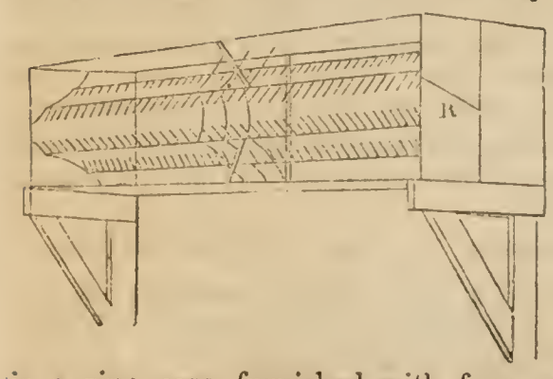


Fig. 99 *f.*

is a zinc case, furnished with four rows points, which is placed in front of the jets in order to collect the electricity from the ejected vapour, and thus prevent its returning to restore the equilibrium of the boiler. When a great quantity of electricity is required, the case is brought within a few inches of the jets; when long sparks are needed, it is moved to a distance of about two feet. The maximum pressure at the commencement of experiments is ninety pounds, which gradually gets reduced to forty or lower.

The portion of the apparatus which is peculiarly connected with the generation of electricity, is the series of bent tubes with their attached jets. Mr. Armstrong very kindly superintended the structure of the boiler, and made repeated experiments in order to determine the most favourable conditions for obtaining the maximum effect. He had seen, with Professor Faraday, that moist steam is absolutely essential to the development of electricity; and, as high pressure steam is *dry* in the jet which proceeds *directly* from the boiler, he has found a means of obtaining just sufficient condensation for the object in view, by interposing the bent tubes, H, between the boiler and the jets, where Faraday placed the "steam globe." For causes which are not at present apparent, he found that tubes of lead or tin were far less efficient than those of iron. The *form* and *material* of the jet exercised very great influence over the results. He has found partridge wood superior to any other material. The wood is formed into hollow cylinders, which are contained within an iron case, as in the annexed figure (*fig.* 100). By this contrivance, Mr. Armstrong is of opinion

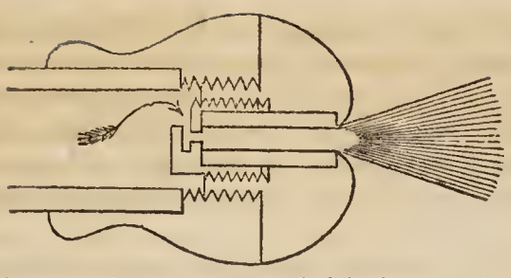


Fig. 100.

that a greater amount of friction against the inner sides of the cylinder is obtained. The particles of water may be thus regarded as the glass plate of an electric machine, the partridge wood as the rubber, and the steam as the rubbing-power.

A PRACTICAL TREATISE ON BREWING, BASED ON CHEMICAL AND ECONOMICAL PRINCIPLES; WITH FORMULÆ FOR PUBLIC BREWERS, AND INSTRUCTIONS FOR PRIVATE FAMILIES. Third edition, much enlarged and improved. By Wm. Black, Practical Brewer. London: Longman and Co., 1844.

Practical works by practical men are always gratifying to us; we are always rejoiced to find those who are experienced in any art laying their accumulated knowledge before their brethren, to whom it cannot fail to be useful.

In the present instance, success seems to have been contingent on merit, for the valuable treatise before us has arrived at a third edition, a good indication of its appreciation by the highly intelligent class of the community concerned in the manufacture of malt liquors, to whom its utility must be very considerable.

This work treats, 1st, of the materials used in brewing; 2nd, of the brewery and brewing apparatus; 3rd, of the various processes of brewing, and fermentation; 4th, an appendix contains a variety of useful matter.

This essay will be found invaluable to the practical brewer and private families; to the former, we recommend it as a work ably treating of their art, to the latter, as one in which they will find an efficient and correct guide. This edition fully bears out the statement on the title page—that it has been "much enlarged and improved."

We subjoin an interesting extract:—

ON THE INJURIOUS INFLUENCE OF ELECTRO-CHEMICAL ACTION IN THE PROCESS OF BREWING.

It is now admitted that electricity is a powerful agent in all processes both natural and artificial. Wherever heat is liberated spontaneously in any process, it must proceed from one or more of the substances employed, acting upon others of a different nature; and where heat is thus produced, it may be supposed to proceed from chemical action, and thus evolving electricity.

Fermentation is a process of this nature, and the production of alcohol may be said to be partly effected by galvanic or electric action. Although fermentation has always been considered a very uncertain operation, and subject to every fluctuation of weather, we entertain some doubts upon that subject, and are also inclined to think that the causes influencing fermentation are not so little under control as may be generally supposed. If alcohol be the production of a regular chemical action during the process of fermentation; by disturbing the progress of that action, it will no doubt materially interfere with the results. If we find that in certain situations, and under certain circumstances, fermentation goes on much more regularly and uniformly than in others, while using precisely the same kind of material, we have a right to suppose that the want of uniformity must proceed from causes which may be traced and removed. That the direct application of common electricity or voltaïc electricity materially affects fermentation, there cannot be the slightest doubt; indeed it is established by several undeniable facts.

We shall, however, in the first place, insert an abstract of a paper on this subject, which was communicated by the author to the British Association, at their meeting in Liverpool, in 1837.

"I trust I may be excused in drawing the attention of the meeting of the British Association to a short notice of the injurious influence which electricity exerts on the fermentation of the worts of the brewer and the wash of the distiller. The powerful and injurious effects produced by this agent in the manufacture of beer, I endeavored to point out, in a little work, lately published, on brewing; which, although it has excited some notices among a few practical men, yet the subject has not received that attention which its great importance deserves. But I entertain a hope that this matter will stimulate some members of the Association minutely to examine the nature and extent of the electrical agency, and, by well-devised experiments (towards which, if required, I should most willingly give any information or assistance) succeed in convincing brewers and distillers of the necessity of studying the laws which regulate this all-powerful agent, in order that they may avoid its injurious effects in the manufacture of beer or spirits. Beer, to the industrious classes in this country, may be considered a necessary of life, and its wholesomeness and purity must, therefore, be of vital importance. The quality varies exceedingly in different parts

of the kingdom, and what is considered good beer in one district may, in other parts, be pronounced *execrable*. One great cause of the inferiority of beer and ale in the country, and of the great diversity of flavor, is the want of competition; it being only in the large towns that effectual competition exists. In the country districts there is little or none. The brewers have been long in the habit of purchasing all the public-houses in their neighbourhood, and these houses being limited in number, the laboring classes are prevented from selecting their own beverage, and have no choice but to drink that of the proprietors of the public-houses, who are also the brewers. Most of such beers are very imperfectly manufactured, and are usually foul and yeast-bitten, and have a very disagreeable, rank-bitter, derived from the yeast left in the beer, instead of its being thrown out by a proper process. This bitter, although often mistaken for it, is very different from the agreeable and aromatic flavor of the hop. Yeast-bitter beer is particularly injurious to wet-nurses in the suckling of infants. In some districts, unsound, stale beer, is the favorite; so that, from long use, good, sound beer, would not be appreciated, but rejected. A frequent cause of such inferior beer proceeds from want of proper attention being paid to cleanliness, which produces tainted worts, and, consequently, bad fermentations. I suspect, however, that it very often proceeds from electric or galvanic agency; the fermenting vessels being very frequently sunk in the ground, are particularly liable to be affected by all electrical and atmospheric changes, as I have had many opportunities of observing. It is to the latter that I wish to direct the attention of the meeting. It has long been familiarly known that thunder sours beer; but, though generally known, very few brewers have inquired into the cause, or adopted means to prevent this atmospheric, or other action, affecting beer during thunder-storms, or in the different electric states of the earth and atmosphere. The extreme rapidity with which electricity is evolved during a thunder-storm is strikingly exhibited in a distiller's fermenting back. These fermenting backs are often made of cast-iron, and either fixed in the earth, or connected with it by an intermediate iron vessel, employed in regulating the temperature. A very short time after a thunder-storm begins, or when the atmosphere is highly charged with electric matter, the atmosphere in the back altogether changes. The usual healthy character of the fermentation disappears; and it is now attended with a hissing noise and frothy head: and when samples are drawn and examined, is found to have risen, instead of fallen, in gravity many degrees, and to contain five per cent., or more, of acid. Under these circumstances, the distiller has no alternative but to run off his wash into the stills, although they may be as high as 10 or 12 degrees above water, or occasionally of much higher rarity.

"But the chemical agency exercised by a highly electrical state of the atmosphere, is not confined solely to the fermentation of vegetable substances; it affects even the smelting of iron. It is well known to iron-masters and smelters, that in certain conditions of the atmosphere, and particularly during sultry summer weather, they can never, with certainty, calculate upon producing good, soft, tenacious iron, technically called No. 1; it is much more generally the white, hard, inferior kind, called No. 3, or a mixture of Nos. 2 and 3. Now, in such circumstances, it will be found that the iron was melted during a thunder-storm, or when the air was highly charged with electricity. In these cases the ore shall be of the best quality, and all the manipulations belonging to the melting be carefully looked after, and even a much greater charge of coke be employed (the *dernier ressort* of the melter), when apprehensive of hard, inferior iron, yet, notwithstanding all these precautions, the yield of iron is of the quality No. 3. The operating cause we consider to be electricity. The result of my observations, in different parts of the kingdom (and they have been pretty widely extended), is, that where the fermenting tuns have been placed upon baked wooden bearers, and supported upon brick or wooden tiers, or columns, and every other precaution used to insulate the vessels as much as possible, the fermentations proceed regularly and progressively, and the beer turns out good, bright, and sound, and will keep so; but when the tuns are placed on, or imbedded in the earth, or when electro action is induced by a chain of copper or metal pipes, making a complete galvanic circle, the fermentations are very irregular, and do not go through their changes in any thing like order, and show only extremely high, light, and puffy heads. Frequently, the attenuation or decrease of specific gravity altogether stops, and the beer becomes sour, or partially unsound, before leaving the fermenting tun. A rather singular attendant on this galvanic action in the fermentation is, the rise of the temperature of the worts in the fermenting tun will, in the course of one night, be 10 to 12 degrees, or more, and without a corresponding attenuation; while, in all healthy fermentations, there is a regular and proportioned decrease of gravity for increase of temperature. This is a point (although at present very little known or at-

tended to) of the utmost consequence in regulating the proper quantities of yeast to be employed as a ferment, according to the specific gravity of the worts, and quality of beer to be produced. A great deal of attention has of late years been bestowed on the mechanical construction of the utensils employed in breweries, in order to diminish manual labor and the waste of beer, and in making them quite *automatic*. In these improvements, unfortunately, too little attention has been paid to the injurious action of galvanism, or electricity. We know of one exception. An extensive establishment in London, well aware of the action induced by electricity, took the wise precaution, a few years since, when erecting fermenting tuns, containing 1,400 barrels each, and supported by iron columns, to have them insulated, from which they have derived great benefit. The same house, sensible of the importance of observing the atmospheric changes, has kept a meteorological journal for the last ten years; the observations being made three times a day—at four o'clock A.M., at nine o'clock A.M., and at three o'clock P.M. In order to prevent the electric action on the fermentations of beer or wash, the vessels should be thoroughly insulated, and the mains, or pipes, leading to or from these vessels should be thoroughly disconnected from them by means of union screws, or perhaps still better, by a short hose of leather, or caoutchouc, or Indian rubber. By these simple means, the galvanic circle, otherwise formed by the metal pipes and webs, &c., employed in removing the worts, refrigerating or cleansing, will be broken, and a uniform, regular, and healthy fermentation be produced. I have been inclined to think that the great difference in the quality of wines which we read of, produced from vineyards within a short distance of each other, may as often be traced to some electrical action, caused by a bad arrangement of the fermenting vessels, as to any difference in the soil or quality of the grapes. I hope these few observations, brief as they are, will draw the attention of men of science, and also of the manufacturer, to the subject, believing it one of primary importance in this branch of the chemical arts.'

Mr. Faraday and Dr. T. Thomson considered the above suggestions particularly worthy of the attention of brewers and distillers.

We know that thunder-storms are caused by the different electric conditions of the earth and atmosphere. Fermenting tuns may be so situated as to be affected by these different electric conditions. We know that milk in some dairies is soured and injured by atmospheric electricity, while in others, differently arranged, no such effect is produced. Most brewers will admit that beer of the same brewing, when sent out in casks, will remain sound in the cellars of some of their customers, while in others it will become acid.

A shock of electricity sent through any beer will speedily cause it to become sour.

Fermenting tuns, when embedded in the earth, are very liable to be affected by the various conditions of atmospheric electricity.

Many instances of injury from such causes have come under the author's observation, from which he selects the following:—

In the summer of 1828, being called into a town in Surrey to superintend some brewings, he found the fermenting tuns were imbedded in the earth, and at once expressed his disapprobation of this mode of placing them, and, at the same time, his doubts of any certainty of success, until the tuns were differently situated. No change of position could, at that time, be made. The fermentations, however, although by no means right, went on indifferently well for several brewings. But in a brewing, which was made on the 2nd of July, the fermentation next day (the 3rd) became quite stationary, with regard both to temperature and attenuation; and, although all the usual means were resorted to, none had the desired effect of forwarding the process. Having previously seen the same cessation of fermentation in an electrically excited state of the atmosphere, he had no doubt but the extraordinary results proceeded from electric action, and stated his opinion to that effect to the brewer and others, at the same time predicting that we should very soon have a thunder-storm. As it is generally considered hurtful to let beer remain in the gyle-tun in a state of total inactivity, it was immediately cleansed by pumping it from the gyle-tun, into casks, placed on wooden stillions about 18 inches high, where it soon began to throw out its yeast very well, and, at the same time, underwent an attenuation of 6lbs. per Long's Instrument. The same evening a thunder-storm came on, which was of unusual violence.

AN INQUIRY INTO THE NATURE OF THE SIMPLE BODIES OF CHEMISTRY. By David Low, F.R.S.E., Professor of Agriculture in the University of Edinburgh. London: Longman and Co.; Edinburgh: A. and C. Black. 1844.

This work is of a most novel and singular character: its object is to induce chemists to regard as compound, until their simple nature shall have been proved, all those bodies, which, not having been composed or

decomposed, are held to be simple or elementary. Now, although the learned Professor has adduced highly ingenious arguments in favor of his proposition, we do not consider that he has succeeded so fully as he seems to imagine.

The difficulty of proving a negative is well known to the least skilled in rules of logic. The supporters of the admitted conception that all bodies which have resisted decomposition, or which the most consummate art has failed to form, must be regarded as simple—that is to say, undecomposed—as opposed to the partizans of the opposite opinion, viz., that all bodies should be held to be compound until their nature has been proved, are on the negative side of the question: the *onus probandi* decidedly rests on the latter; therefore, it is their province to demonstrate that the so-called elements are compound; to attempt to show that they are simple, would be endeavoring to prove a negative, simplicity of constitution being regarded as the negation of complexity of constitution.

As in legal and ethical philosophy, it is a well-known axiom, that "a man shall be regarded as innocent until his guilt be proved"—innocence consisting in the absence of guilt, and, therefore, being the negation of guiltiness—so in physical science must all bodies be regarded as simple until satisfactory proofs of their compound nature be brought forward.

Now, Professor Low admits that facts, although they do not oppose, support not his hypothetical reasoning. He sets out with the avowal that facts favor neither the simple or negative, nor the complex or affirmative side of this question. He therefore resorts to induction to uphold his views. Now, although inductive reasoning, *aided by facts*, is to a certain extent admissible, we cannot accept it as a substitute for facts, merely because no facts can be found to support it. For our own part, we prefer one well-directed and properly-performed experimental result—one fact—to all the reasoning in the world—unless that reasoning be based on facts. In such reasoning as that to which the ingenious Professor has resorted, there is nothing satisfactory, because it starts from no point of admitted truth.

It is the object of the author to prove that all the 55 simple bodies of chemistry may be reduced to two common roots—hydrogen and carbon; or, into three common roots—hydrogen, carbon, and oxygen: but, as he regards the third as composed of the former two, two common roots suffice. His arguments are based on the combining weights of these bodies. "Thus," says he, "the atomic or combining weight of hydrogen being 1, and that of carbon 6·04 (according to recent experiments"), that of oxygen—according to him H ^{2}C—must be 8·04, (8·01 being the atomic or combining weight of oxygen, according to actual experiment.) Thus he infers that oxygen, and all the other simple bodies, are compounds of H C, the proportion of each of these roots varying in all, and this variation accounting for the difference of properties.

Our readers will be better able to form an idea of the author's views from the following table:—

TABLE SHOWING THE POSSIBLE DERIVATION OF THE SIMPLE BODIES OF CHEMISTRY FROM COMMON ROOTS.

Simple Bodies.	I. Derivation from the roots H, C, O.	II. Derivation from the roots H, C.	III. Combining weights determined by experiment.	IV. Combining weights, the roots being H, C.
1. Hydrogen	H		1	1
2. Carbon	C		6·04	6·04
3. Oxygen	O	H^2 C	8·01	8.04
4. Nitrogen	H C O	H^2 C^2	14·19	14·08
5. Phosphorus	H C O	H^3 C^2	15·72	15·08
Or,	H^3 C^2 O^2	H^7 C^4	31·44	31·16
6. Sulphur	H^2 C O	H^4 C^2	16·12	16·08
7. Selenium	$H^{11}C^2$ O^2	$H^{15}C^4$	39·63	39·16
8. Tellurium	H^8 C^4 O^1	$H^{16}C^8$	64·25	64·32
9. Fluorine	H^4 C O	H^6 C^2	18·74	18·08
10. Chlorine	H^7 C^2 O^2	$H^{11}C^4$	35·47	35·16
11. Bromine	H^8 C^5 O^5	$H^{18}C^{10}$	78·39	78·40
12. Iodine	$H^{14}C^8$ O^3	$H^{30}C^{16}$	126·57	126·64
13. Arsenic	H^9 C^2 O	$H^{13}C^4$	37·67	37·16
14. Antimony	H^8 C^4 O^4	$H^{16}C^8$	64·62	64·32
15. Bismuth	$H^{15}C^4$ O^1	$H^{23}C^8$	71·07	71·32

Simple Bodies.	Derivation from the roots H, C, O.	Derivation from the roots H, C.	Combining weights determined by experiment.	Combining weights, the roots being H, C.
16. Chromium	$H^{14}C\ O$	HC^2	28·19	28.08
17. Uranium	$H^{12}C^3\ O^3$	$H^{18}C^6$	54·31	54·24
18. Molybdenum	$H^5\ C^3\ O^3$	$H^{11}C^6$	47·96	47·24
19. Tungsten	$H^{10}C^6\ O^6$	$H^{22}C^{12}$	94·80	94'48
20. Tantalum	$H^2\ C^{13}O^{13}$	$H^{28}C^{26}$	184·90	185·04
21. Vanadium.....	$H\ ^2C^4\ O^4$	$H^{20}C^8$	68·66	68·32
22. Silicium		H C	7·41	7·04
Or,	$H^8\ C\ O$	$H^{10}C^2$	22·22	22·08
23. Boron		H C	7·41	7·04
Or,	$H^8\ C\ O$	$H^{10}C^2$	22·22	22·08
24. Titanium	$H^{10}C\ O$	$H^{12}C^2$	24·33	24·08
25. Gold	$H\ C^7\ O^7$	$H^{15}C^{14}$	99·60	99·56
26. Osmium	$H\ C^7\ O^7$	$H^{15}C^{14}$	99·72	99·56
27. Iridium.....	$H^{14}C^6\ O^6$	$H^{26}C^{12}$	98·84	98·48
28. Platinum	$H^{14}C^6\ O^6$	$H^{26}C^{12}$	98·84	98·48
29. Rhodium	$H^{10}C^3\ O^3$	$H^{16}C^6$	52·20	52·24
30. Palladium.....	$H^{11}C^3\ O^3$	$H^{17}C^6$	53·36	53·24
31. Silver	$H^{10}C^7\ O^7$	$H^{24}C^{14}$	108·30	108·56
32. Mercury	$H^3\ C^7\ O^7$	$H^{17}C^{14}$	101·43	101·56
33. Copper.....	$H^7\ C^4\ O^4$	$H^{15}C^8$	63·42	63·32
34. Zinc	$H^4\ C^2\ O^2$	$H^8\ C^4$	32·31	32·16
35. Cadmium	$H^{13}C^3\ O^3$	$H^{19}C^6$	55·83	55·24
36. Tin	$H^2\ C^4\ O^4$	$H^{10}C^8$	58·92	58·32
37. Lead.....	$H^5\ C^7\ O^7$	$H^{19}C^{14}$	103·73	103·56
38. Cobalt	$H^{15}C\ O$	$H^{17}C^2$	29·57	29·08
39. Nickel	$H^{15}C\ O$	$H^{17}C^2$	29·62	29·08
40. Iron	$H^{13}C\ O$	$H^{15}C^2$	27·18	27·08
41. Manganese	$H^{14}C\ O$	$H^{16}C^2$	27·72	28·08
42. Cerium.....	$H^4\ C^3\ O^3$	$H^{10}C^6$	46·05	46·24
43. Lantanium				
44. Thorium	$H^3\ C^4\ O^4$	$H^{11}C^8$	59·83	59·32
45. Zirconium.....	$H^5\ C^2\ O^2$	$H^9\ C^4$	33·67	33·16
46. Aluminum		H C^2	13·72	13·08
Or,	$H^{13}C\ O$	$H^{15}C^2$	27·44	27·08
47. Yttrium	$H^4\ C^2\ O^2$	$H^8\ C^4$	32·25	32·16
48. Glucinum.....	$H^{12}C\ O$	$H^{14}C^2$	26·54	26·08
49. Magnesium		H^6 C	12·69	12·04
50. Calcium	$H^6\ C\ O$	$H^8\ C^2$	20·52	20·08
51. Strontium.....	$H\ C^3\ O^3$	$H^7\ C^6$	43·85	43·24
52. Barium.....	$H^{12}C^4\ O^4$	$H^{20}C^8$	68·66	68·32
53. Lithium	$H^9\ C\ O$	$H^{11}C^2$	23·31	23·08
54. Sodium.....	$H^9\ C\ O$	$H^{11}C^2$	23·31	23·08
55. Potassium.....	$H^{11}C^2\ O^2$	$H^{15}C^4$	39·26	39·16

To which add the following compound bodies :—

1. Cyanogen..... $C^2N = C^2 + CO$
   $= C^2 + H^2C^2 = H^2C^4$

2. Ammonia..... $H^3N = H^3 + CO$
   $= H^3 + H^2C^2 = H^5C^2$

3. Ammonium ..... $H^4N = H^4 + CO$
   $= H^4 + H^2C^2 = H^6C^2$

It is a long time since we have read a work more deserving of perusal, and we hope that every chemist will hasten to possess himself of a copy. The arguments are those of a man who thinks for himself, notwithstanding that we do not consider them sufficient. The learned and talented Professor expresses himself clearly, and in language such as a tyro may comprehend. In fact, it is an able, intelligent, and even agreeable book.

We regret that it is not in our power, owing to very extensive professional engagements, to take up the subject more fully, but our columns shall be open to any chemist who may have more leisure than we have at present to do. The subject is, to our mind, full of interest.

TO OUR CONTRIBUTORS.

We shall esteem it a favor if those gentlemen who intend to favor us with papers for insertion in our next number, will be kind enough to let us have those which belong to the department of Chemistry, by the 8th inst.; those in Chemical Manufactures and Agricultural Chemistry, by the 12th; and those in Pharmacy, by the 15th.

We shall also feel obliged if those who intend to contribute in the course of the present year will transmit to us their names as early as convenient, stating, if possible, to which division of this Journal their articles will belong, as we are about to publish a List of Contributors.

TO OUR READERS.

Our talented correspondent, H., requests us to insert an apology for him, great pressure of business having compelled him reluctantly to postpone the continuation of his valuable series of letters on Excise Restriction, &c., until next month. We know that no one can regret the delay more than himself.

Mr. Charles Watt, jun., is also a petitioner for clemency; his article on Acidimetry will, however, without fail appear in our next.

We are almost ashamed to mention the article on Alcohol referred to in our January number, circumstances over which we have no control having rendered its postponement imperative. It shall appear as speedily as possible, perhaps in our next.

In consequence of press of matter, we are compelled to postpone the insertion of the Meteorological Table until next month.

BOOKS RECEIVED.

"Medicines, their Uses and Mode of Administration; including a complete conspectus to the three British Pharmacopœias, an Account of all the New Remedies, and an Appendix of Formulæ." By J. Moore Neligan, M.D. London: Longman and Co., Dublin: Fannin and Co., 1844.

"The Polytechnic Magazine." Edited by Thomas Stone, M.D.

TO CORRESPONDENTS.

A letter from Mr. Woodward has just been found; it was mislaid, but shall be answered immediately, by post.

Virtutas.—We have to apologise for not having answered your letter earlier. We do not consider that the position of the question admits of a positive decision on our part.

W. S. Heywood will receive a letter from us in the early part of the month.

Several correspondents, who state that they have found Mr. Thompson's method of dissolving balsam of copaiba produce an opaque instead of a clear solution, are informed that it is more than probable that they have used an impure balsam.

We have to acknowledge, and from their great number we can only do so in general terms, the receipt of letters, from members and associates of the Pharmaceutical Society, all denouncing in no measured terms the system on which that Society is managed. We advise these gentlemen to use their own common sense. Their names shall be kept secret.

Numerous correspondents answered by post.

ERRATA, No. XLIX.

Page 3, col. 1, 2nd line from bottom, for "tortoise" read "tortoishell."

Page 3, col. 2, line 26th, for "opposition" read "supposition."

Page 4, col. 2, 12th line, for "Jones" read "Founes."

Page 4, col. 2, 7th line from bottom, for "with" read "on the."

Page 5, col. 1, 25th line, after "ammonia" omit the words "and water."

Page 5, col. 1, 9th line from bottom, for "least" read "best."

Nota Bene.—*All Communications, Books for Review, and Substances to be Analysed, must be addressed "To the Editors of the Chemist, 310, Strand, London." Communications must be prepaid, and sent before the 15th of each month; Books for Review before 10th.*

THE CHEMIST.

I. CHEMISTRY.

ON THE PRODUCTS OF THE OXIDATION OF PROTEIN IN THE ANIMAL ORGANISM.*

BY J. G. MULDER.

(*Concluded from page* 104.)

PORTION INSOLUBLE IN WATER AND ALCOHOL.

0·557, which contained 0·016 of ash, gave 116·5c.c. of nitrogen at 59°F., and 772·7m.m. before the experiment, and 782c.c. at 53·6°F. and 77 2·4m.m. after the experiment; 0·545 gave 1·052 of carbonic acid and 0·341 of water.

Carbon.....	54·99
Hydrogen.....	7·16
Nitrogen.....	15·33
Oxygen.....	22·52
	100·00

The same body insoluble in water arising from another preparation, and furnished by albumen after an ebullition of 150 hours, and after previous treatment by alcohol, acted as follows by analysis:—

0·268 gave 0·006 of ash.
0·529 ,, 1·020 of carbonic acid and 0·330 of water.

Carbon.....	54·55
Hydrogen.....	7·09

If the results of the analysis of the body of the buffy coating, soluble in water and insoluble in alcohol, be compared with the above extracted from fibrin, after an ebullition of four hours, or by the action of heat in Papin's digester, or else from albumen after prolonged boiling, a perfect identity is observed. The composition of all these bodies may be expressed by the following formula:—

40 atoms	Carbon.....	51·45
64 ,,	Hydrogen.....	6·72
10 ,,	Nitrogen.....	14·92
16 ,,	Oxygen.....	20·93

This is the composition found for the tritoxide of protein obtained by treating a solution of albumen, caseïn, or fibrin by chlorine. There is then formed a flacculent precipitate of the formula $C^{40}\ H^{62}\ N^{10}\ O^{12} + Cl^2\ O^3$. If ammonia be poured on this latter, if it be evaporated and treated by alcohol, hydrochlorate of ammonia is dissolved, and $C^{40} H^{62} N^{10} + H^2O$ remains.

This is the same body as is found in inflamed blood, and which is formed by the ebullition of fibrin and albumen (probably also of caseïn). We retain the name of tritoxide of protein, without, however, attaching to it any other signification than the presence in this substance of three atoms of oxygen more than in protein. Protein is a very complex body: oxidation can probably be effected on only one of its principles; but the combination of new formation remains united with the other principles of protein. Whatever may be the mode of preparation, whether it be extracted from chloride of protein, or obtained by the ebullition of the buffy coating, or by the decomposition of fibrin and albumen at the boiling temperature, it always possesses the same properties. In combination with the metallic oxides, it forms double salts composed according to the formula:—

$(O^{40}\ H^{62}\ N^{10}\ O^{15} + MO) + (C^{40}\ H^{62}\ N^{10}\ O^{15} + H^2\ O)$.

The body obtained by the ebullition of fibrin or albumen with water, also gives a similar combination; but it is not possible to obtain it free from the glass which is dissolved; I have not gone further into its study.

* *Annalen der Chemie und Pharmacie.*

The properties of tritoxide of protein, as it is extracted from chlorite of protein by aid of ammonia, are the same as those of the same combination arising from the buffy coating, or obtained by the ebullition of fibrin and albumen with water. It is soluble in cold water,* insoluble in alcohol, ether, and the volatile and fatty oils; it has neither acid nor alkaline reaction.

It is always precipitated in the same manner from the more or less concentrated aqueous solution by the nitric (dilute), sulphuric, hydrochloric, tribasic phosphoric and tannic acids; by liquid chlorine, corrosive sublimate, and neutral and basic acetates of lead; the solution of tritoxide of protein extracted from chlorite of protein, generally gives rather more precipitate with the foregoing reagents: if the acetic acid liberated during the precipitation be saturated with ammonia, all is precipitated in such a manner, that if an excess of ammonia be not added, none of the organic combination will remain in the liquor. The solution is also precipitated by nitrate of silver, sulphate of zinc, and peroxide of iron. It is not precipitated by dilute acetic acid, by the neutral salts of potassa and soda, by ferrocyanuret of potassium, which is a very sensible reagent for detecting the presence of protein, by chloride of barium, nor by hydrochlorate of ammonia.

The tritoxide of protein gradually dissolves in potassa, soda, and ammonia. If the excess of ammonia be removed from the latter solution, a neutral salt of ammonia is obtained, which forms combinations with the neutral metallic salts. I have carefully examined those which I had obtained with tritoxide of protein, extracted from chlorite of protein. I have not prepared salts with the tritoxide of protein arising from ebullition, because they are never obtained so pure.

The insoluble body, which fibrin and albumen leave after ebullition in water, furnishes, by fresh boiling, a new quantity of the substance soluble in water. The undissolved residue differs from fibrin and albumen, a fact worthy of attention, because it explains an error in the investigations of M. Dumas (See THE CHEMIST, Vol. IV, 1843, pp. 10, 49). Indeed, by the ebullition of fibrin, we have at first a mixtrue of fibrin and of an insoluble body whose quantity always increases by the prolongation of the boiling, whilst that of the fibrin diminishes; finally, a substance of uniform composition is obtained, which is represented by the following formula:—

40	Atoms	Carbon	53·36
62	"	Hydrogen ..	6·75
10	"	Nitrogen	15·45
14	"	Oxygen	24·44

Dr. Von Laer has extracted from hair a body of similar composition to which Scherer first called attention. It has been called binoxide of protein, and is obtained from the solution of hair in potassa by precipitating first the protein by a small quantity of acid, then adding a great quantity which precipitates the body in question. The two equivalents of sulphur which hair contains are converted with 2 KO, into 2 KS and O^2; the latter unite with C^{40} H^{62} N^{10} O^{12}.

The same body is obtained with 14 atoms of oxygen, in quite another manner, by the ebullition of fibrin in water. It is this which is formed at first from protein by the action of the oxygen of the air; then it gives rise, by the addition of another equivalent of oxygen, to the body soluble in water above mentioned. It is, probably, this substance which M. Dumas has analysed instead of fibrin; it contains less nitrogen, carbon, and hydrogen.

Albumen is, in this respect, entirely different from fibrin. Ebullition does not, at first, convert it into binoxide of protein; but it is immediately changed into tritoxide. The insoluble portion remaining is unaltered albumen. Now, nothing is more natural than to suppose also the existence of this binoxide of protein in the buffy coating; since the tritoxide is found there in great quantity. The results of analysis agree in showing that the buffy coating is a compound of binoxide and tritoxide of protein.

We see, therefore, that the buffy coating contains binoxide and tritoxide of protein; that the ebulition of fibrin, for a short time, produces the latter; that boiling for a long time gives rise to both, but that with albumen only tritoxide is formed.

It now remains to be ascertained whether the tritoxide of protein really prëexists in more or less considerable quantity in fibrin. To judge from the rather smaller proportion (but not at all greater, as M. Dumas stated) of nitrogen and carbon which I have found in my preceding analysis, the thing is not improbable; but it is difficult to prove it by elementary analysis, because oxyprotein has a composition resembling that of protein. The property discovered by Scherer in fibrin, of absorbing oxygen while in the humid state, powerfully supports this supposition. According to this property, fibrin should be richer in oxygen, as it has, during its preparation, been longer in contact, while moist, with the air.

* Extracted from chlorite of protein, it is, after a very powerful desiccation, less soluble in water and a little colored; the others are white: the more it is colored, the more its composition differs from the others; it may even give 1 per cent. of carbon less in analysis.

According to an observation of M. Bouchardat, very dilute hydrochloric acid possesses the property of dissolving albumen, but not coagulated albumen. This property is important for the study of digestion, since it results from it that the very dilute gastric juice is capable of dissolving fibrin without the aid of the pretended pepsin (?).

If half a thousandth of hydrochloric acid be mixed with one-tenth of humid fibrin, and one part of water, the fibrin very promptly becomes gelatinous. Meat also undergoes an analogous change.

This observation has been confirmed by Von Baumhauer. The fibrin is dissolved; but it leaves, according to Bouchardat, a slight residue, which does not dissolve. He, very wrongly, names this latter *epidermose*, and he gives the name of *albuminose* to the dissolved portion. Other dilute acids act like the hydrochloric, only their action is slower. The gluten of wheat undergoes, according to M. Bouchardat, the same change as fibrin; he did not perceive epidermose in it. The albumen of eggs and serum, as well as caseïn, also give, with hydrochloric acid, according to M. Bouchardat, a solution of albuminose.

These important facts merited a more attentive examination, more especially as M. Bouchardat advances that all the solutions of fibrin, gluten, albumen, and caseïn, in weak hydrochloric acid, act absolutely in the same manner with reagents, and must, consequently, contain the same bodies.

It was important, in repeating the above-mentioned experiments, to determine by elementary analysis the nature of the pretended epidermose, a body which should contain fatty matters, and which, according to M. Bouchardat himself, remains in only very small quantity; besides, the precipitation by means of carbonate of ammonia, should separate the albuminose from the liquor without hydrochloric acid being mixed with it.

There was every reason to suppose that epidermose was binoxide of protein. This substance is found only in small quantity in fibrin, whilst almost as much albuminose is obtained as there was fibrin taken. If it were thus, that fibrin contained binoxide of protein, in however small quantity, this fact might be important for the explanation of many of the phenomena of life.

Whatever were the quantity of fibrin submitted to examination in this laboratory, sufficient epidermose for analysis could never be obtained. But the properties of this substance so greatly resemble those of the binoxide of protein, that it is impossible to doubt the identity of these two bodies. It completely differs from the epidermis; thus the name of epidermose cannot be retained.

Albumen and fibrin, or the portion soluble in hydrochloric acid, precipitated by carbonate of ammonia, and treated by alcohol, gave to Von Baumhauer, by analysis, the following results:—

(No appreciable quantity of ash.)

I. 0·7545 gave 1·464 of carbonic acid & 0·4675 of water.

II. 0·520 ,, 1·009 ,, 0·320 of water.

0·587 at 58·1°F., and 764·9^{mm}. 120·5$^{c.c.}$ of nitrogen before the experiment, and 195·2 at 45·2°F. after the experiment.

These numbers amount to:—

	I.	II.
Carbon.....	53·64	53·65
Hydrogen.....	6·88	6·73
Nitrogen.....	15·88	,,
Oxygen.....	23·64	,,

This albuminose is then likewise a product of the oxidation of protein, to which the substance produced and afterwards dissolved by, the hydrochloric acid gives rise, doubtless by the absorption of oxygen from the air. It is tritoxide of protein $C^{40}\ H^{62}\ N^{10}\ O^{15}$.

It appears to me probable, from this observation, that the bodies above described, contained a product of the oxidation of protein, resulting from the absorption of oxygen by the gelatinous combination of precipitated protein; however, this fact requires a more attentive examination. It does not the less result that it is not easy to execute in the air an operation of protein or some of its combinations, especially fibrin, without a more or less considerable quantity of binoxide or tritoxide of protein being formed. This property seems less powerful in protein precipitated from the solution of potassa, but it is more powerful with fibrin.

The substances contained in the serum of the blood, and which remain dissolved in it, after the fibrin, hæmatin, and albumen have been removed, by the coagulation of the blood by means of heat, are of the greatest importance. Investigations concerning this subject are being carried on, and I may say provisionally, that the serum of blood, freed from fibrin, hæmatin and albumen, gives, by the addition of metallic salts, a precipitate of tritoxide of protein. The foregoing analytical results may be summed up in the following terms:—

1. False membranes contain gelatine, arising from the serous membrane in which they are formed. The other principles are products of inflammation, and should have the composition of the buffy coating.

2. The buffy coating is a combination of two oxides of protein: $C^{40}\ H^{62}\ N^{10}\ O^{14}$ and

$C^{40}\ H^{62}\ N^{10}\ O^{15} + H^2\ O$.—It probably does not contain fibrin, properly so called.

3. The buffy coating is formed by the fibrin and not by the albumen of the blood.

4. Fibrin very readily absorbs, even at the ordinary temperature, oxygen from the air, and forms the two above-mentioned oxides of protein. It is for this reason that fibrin always gives rather less carbon, hydrogen and nitrogen than albumen, because fibrin cannot be prepared under shelter from the air.

5. The epidermose of M. Bouchardat, is probably the first, but his albuminose is certainly the second of the two above-mentioned oxides of protein.

6. Albumen does not give binoxide, but it immediately forms tritoxide by the absorption of oxygen; albumen, also, always presents a greater proportion of carbon, hydrogen and nitrogen than fibrin.

7. These two products of the oxidation of protein, are obtained, very slowly by the ebullition of fibrin in water, in contact with the air: albumen furnishes only tritoxide.

8. The portion which is not dissolved after the ebullition of fibrin in water and alcohol, is binoxide. In this case, on account of its insolubility, the albumen undergoes no alteration.

9. The bodies soluble in alcohol, which are obtained by the ebullition of fibrin or albumen in water, are products of the decomposition of tritoxide of protein. Such, also, is the origin of the ammonia which is obtained in the distillation of fibrin or albumen in water.

10. The products of the oxidation of protein which have been mentioned, are always found in the blood; they are formed in the lungs by fibrin, that is to say, by the principle of the blood which is collected in the coagulation of this fluid into fibrin under the form of filaments and *faisceaux*; the fibrin oxidised in the lungs, is the chief if not the only conductor of the oxygen of the air; it is the substance which especially gives rise to the formation of the secretions.

11. In the inflammatory state the body contains a much greater quantity of oxy-protein, than it presents in the ordinary normal state.

CONCLUSIONS.

The examination of the foregoing facts leads to some important conclusions. We see that the ebullion of albumen or fibrin, in contact with atmospheric air, gives rise to an absorption of oxygen, by the combinations of protein proportionate to the length of the ebullition, and that, finally, all the fibrin is converted into oxide of protein, which is not the case with albumen.

It results that, by the ebullition of meat, for example, protein is converted into two oxides, and is thus no more presented to the organism in nutriment in the state of protein; that in the ingestion of boiled or roasted meat (indeed, the interior of roasted meat undergoes a change analagous to that which ebullition produces), one part of the protein is converted into binoxide, which renders it hard and sparingly soluble. Another part is changed into soluble tritoxide, and both are then absorbed by the digestive tube, no longer in the state of protein, but in that of the oxides of this substance. The tritoxide, or the portion rendered soluble by ebullition, should, therefore, be found in the extract of meat. Now, as albumen does not undergo the same alteration as fibrin, by ebullition, there exists, also, an essential difference between boiled or roasted meat and boiled albumen, employed as aliments.

In inflammation, the blood presents a greater quantity of binoxide and tritoxide of protein, substances which are also obtained by the ebullition of fibrin, and the latter of which is also furnished by the ebullition of albumen. M. Bouchardat found in fibrin a principle which he called epidermose, which is insoluble in dilute hydrochloric acid and which is probably formed of binoxide of protein. Now, Scherer found that fibrin, in contact with oxygen, absorbs a greater quantity of this gas, and that it is replaced by a smaller quantity of carbonic acid. He observed, moreover, that arterial fibrin, the buffy coating, fibrin obtained by beating up blood, that which was exposed to the air or maintained for a few moments in ebullition, or which was in contact with alcohol (a liquid which contains much oxygen), did not dissolve in the mixture of M. Denis,—a property which belongs to binoxide of protein. Protein gave rise, therefore, in all these experiments, to the formation of a body containing more oxygen than the latter. Now, as we have obtained oxides of protein under the influence of the boiling temperature; as we have separated them in great quantity from the buffy coating; as, moreover, the epidermose of M. Bouchardat, is only binoxide of protein, it results that protein may be further oxidised in the blood; that the albumen of the blood, which furnishes only tritoxide by ebullition, probably takes no part in this alteration, but that it is operated by fibrin only, which absorbs oxygen from the air so slowly, and is converted with so much facility by boiling, into binoxide and tritoxide: it results, moreover, that this more advanced oxidation really takes place in inflammation, and that the two oxides which the blood always presents in great quantity in inflammation should also be constantly found in healthy blood. Both states, the normal and inflammatory, differ only in the quantity of binoxide and

tritoxide of protein found in the blood not being the same. Between these two extremes there may, however, be many intermediate states induced indubitably by different diseases.

The protein of the blood, principally fibrin, is, therefore, a conductor of oxygen. Presented to animals in plants in combination with sulphur and phosphorous, dissolved in the *primæ viæ* and poured into man in the left subclavian vein, it should be partially oxidised in the lungs, where it comes in contact with oxygen. This portion takes the form of binoxide of protein (the epidermose of M. Bouchardat). Hæmatin is not, therefore, the sole conductor of oxygen, but protein itself is another. Arterial blood contains, with albumen and the elements of fibrin (that is to say of the substance which unites in filaments in the coagulation of blood) two other principles—binoxide and tritoxide of protein, which are conducted to different parts of the body. The oxygen absorbed in the lungs commences, even in those organs, its action on protein; there circulate in the body other substances besides the sulphuro-phosphuretted combination of protein, and besides fibrin and albumen ; these are the degrees of oxydation of protein, produced in the lungs by one of the two bodies, or by both at once, which then give up their oxygen in the capillary system, in order to give rise to chemical alterations in it, and to return in the venous blood a smaller quantity or even no oxyprotein, which is then found to be replaced by new products arising from the capillary system.

There is, therefore, operated in the respiration a true oxidation of the blood, or rather of protein, and in inflammation, in which the blood contains a greater quantity of binoxide and tritoxide than in the healthy state, a higher oxidation of this body really takes place. The ancient opinion respecting inflammation, which was supported by no investigation, and which was even based on incorrect data, is now found confirmed by these experiments, a very singular result ; the blood, indeed, contains more oxygen in inflammation.

Hence it occurs that, in the acceleration of the respiratory act, in fevers, for example, inflammation so easily supervenes after violent and sustained efforts. Every fit of fever must necessarily cause the formation of a greater quantity of oxyprotein in the body, and every augmentation in the quantity of oxyprotein must produce an inflammation, which may, in its turn, determine fever. Hence also, it happens that the irritating aliments and drinks which accelerate respiration in a given time, or cold air, which introduces more oxygen into the blood, consequently, give the first impulse to the development of inflammation in the organism. The buffy coating is formed when oxyprotein predominates in the blood, and a partial inflammation is produced when it accumulates in a particular place.

The consequence of this phenomenon is the formation of new productsof false membranes ; for example, in the serous membranes, induration in another place, products which should be formed of the same substance, as the buffy coating—of oxyprotein.

The deoxygenising substances which may arrive in the blood, should, consequently, combat the inflammation.

In the latter there is no more fibrin, but more oxyprotein ; this substance is the most important principle of the buffy coating, which gives much tritoxide of protein by gentle boiling with water. Now, the inflammation is combatted by endeavoring to diminish the quantity of this tritoxide of protein, and to prevent its formation in the lungs.

In what manner do known antiphlogistic means accomplish either of these two objects? It is not difficult to explain this, now that we have ascertained the nature of inflammation. I shall return to this subject in greater detail at a future period.

Bleeding directly diminishes the quantity of oxiprotein, consequently, it exerts an antiphlogistic action ; the augmentation of the secretion of the digestive tube, for example, produces a similar effect by accelerating the exchange of substance in the body, and, consequently, also, the consumption of a greater quantity of the oxyprotein the blood. In a word, there exists no opinion concerning the action of an antiphlogistic means which is not in perfect accordance with the presence of oxyprotein in the blood.

If we reflect for a moment on the presence of oxiprotein in healthy arterial blood, we have explained to us the great quantity of oxygen absorbed by the lungs—a quantity which can never be put in comparison with that of hæmatin. This substance exists in much too small proportion for the large quantity of oxygen absorbed in the lungs at each respiration to be attributed to it. Another conductor of oxygen must, at all events, be found in arterial blood; we have found in fibrin (that is to say, in the substance which furnishes fibrin by the coagulation of the blood) the body which fulfils this function. The arterial blood, rich in oxyprotein, penetrates into the different organs, and, whilst the unoxidised protein passes, perhaps without alteration, into the proper organs of secretion, in order to arrive in the venous blood, the oxyprotein of the arterial blood is freed

from its oxygen in the secretory organs; hence the oxidation of the substances which exist in the body, and the formation of the carbonic acid of respiration. Do the elements of protein deprived of its oxygen then return by the veins in the state of protein (fibrin or albumen)? This is a question which new investigations and analyses of venous and arterial blood must decide.

If oxyprotein once formed in the lungs, is not again changed into fibrin or albumen in its passage through the body, the unoxidised protein of the organism (fibrin) may serve for the formation of muscular fibre, and the oxidised part for that of the cellular tissue, of chondrine, and of the principles of the corneous system, whilst the lungs and the liver eliminate from the body the residues of the aliment which do not contain protein and oxyprotein, which serve for secretion. All these phenomena merit a more ample development; it is sufficient here to know that oxidised protein exists in the organism under two different forms, in small quantity in healthy blood, and in greater quantity in inflammation.

It now remains to be determined whether the products of the oxidation of protein exist in plants as well as in animals. However, it is more than probable, according to the foregoing investigations, that plants do not contain fibrin.

GENERAL CONSIDERATIONS AND INDUCTIONS RELATIVE TO THE MATTER OF LIVING BEINGS.*

BY M. E. CHEVREUL.

(*Concluded from p.* 107.)

Modern chemistry, in discovering the nature of the atmosphere, of water, of carbonic acid gas, and of the immediate principles of plants and animals, has perfectly defined the relations existing between organised beings and the matter at the expense of which they grow, since it has found in the latter all the elements of the former. But, after the discovery of this general relation, extremely numerous and very difficult investigations had to be made in order to explain how it happens, chemically speaking, that an aliment taken by an animal can be reduced into one portion which penetrates into the interior of the organs in order to maintain them in the living state, whilst the rest is rejected. I foresee that I comprehend among the assimilable matters, either immediate principles, as the phosphates of lime and magnesia, which tend to harden the osseous tissue of vertebrate animals by being assimilated; or matters which would have no other part than to pass into a liquid, like the blood, in order to be burned in it under the influence of some supporter of combustion, such as oxygen, in order to give rise to heat and to ponderable products which would be wholly, or only partially rejected, whilst the rest would be assimilated by some other organ in order to nourish it.

If it be wished to study assimilation, in a chemical point of view, according to the foregoing considerations, we may proceed in the following manner:—

The first investigation would have the object of ascertaining whether in the matter which a living being derives from without in order to be nourished by it, there would not be a portion which would pass without alteration into the organs towards which the assimilable portion of the aliment is carried.

If these organs contained globules, it would be necessary to ascertain whether the aliment contained them before its introduction into the organised being; and if this being had a stomach, they should be looked for in the aliment which had remained there a certain time.

In a case in which the foregoing investigation would not give a positive result, or, which to a certain extent comes to the same thing, in which there would be more assimilated matter than globules, it would be necessary to make every endeavor to find in the assimilated matter the immediate principles which form part of the aliment. For example, in cases where manures contain immediate principles scarcely or not at all altered, like various preparations of blood now employed in agriculture, it must be ascertained whether there are any principles which may be absorbed without alteration, and whether there can be any assimilation without conversion of the matter into more simple compounds.

Finally, if this result were arrived at, if none of the immediate principles of the aliment were found in the living beings, the investigations would naturally be directed to the conversion of those principles into matter assimilable by their being nourished by them. Nothing is better adapted to elucidate this very obscure part of physiology than the study of what I have called the *equivalent compositions* of the compound bodies in general, and of the immediate principles of vegetables and animals in particular.

I call *equivalent compositions*, the different molecular arrangements to which known

* *Journal de Pharmacie*, January, 1844.

elements may conform and in given proportions,* for example :—

Alcohol represented by $^{2}O\ ^{4}C\ ^{12}H$ has, for equivalent compositions :—

$$\left\{\begin{array}{l} 4\ (C^{2}H) + 2\ (H{\cdot}H) \\ \text{Bicarburetted hydrogen} \quad \text{Water} \\ O + (^{4}C^{10}H) + (H{\cdot}H) \\ \text{oxygen} \quad \text{ethule} \quad \text{water} \end{array}\right.$$

It is evident that the equivalent compositions are the most valuable materials that can be employed with the view of determining the arrangement of the atoms which constitute the compound bodies in general, and that the investigation of these compositions applied to the immediate principles of organic beings is the basis of every study concerning the numerous transformations which matter, derived by these beings from the external world, undergoes, when once it is introduced into their organs in order to be assimilated.

To the subject of assimilation, regarded as I have viewed it, is attached the important question concerning the variations of immediate compositions which organised beings are susceptible of undergoing in each of the types constituting either a variety or a race : the solution of this general question would comprehend that of several secondary questions, which I here point out.

I. To what point may the immediate principles which constitute an organised being vary in their respective proportions, without the individual deviating from its type ?

II. At what point does the preservation of types cease to be possible from the absence of one or several immediate principles, or of the alimentary matter proper for developing these principles ?

III. One or several immediate principles, or, which amounts to the same thing, the alimentary matter proper for forming it or them, being wanting, cannot they be replaced by one or more immediate principles, or else, which amounts to the same, by an alimentary matter proper for forming them ?

If certain immediate principles can replace others in the living beings, we have thus *equivalent* immediate principles ; moreover, if the aliments furnish equivalent immediate principles, these aliments will be *nutritive equivalents*, which must not be confounded with the aliments which are called equivalents because they have the property of fattening equally the same animals.

This mode of regarding the composition of the matter which constitutes organised beings, leads us to class the immediate principles of these beings into three categories.

I. Into *principles essential* to the existence of the species in which we find them, so that, one of them being wanting, life is no longer possible in the being in question, and, besides, this principle cannot be replaced by another.

II. Into *principles essential* to the existence of the species in which we find them, so that, one of them being wanted, life is no longer possible in the being in question ; but the existence of the being would be possible if this principle were replaced in it by another.

III. Into *accidental principles*, which may be found in individuals of the same species and wanting in others.

These investigations are connected not only with the physiology of a species, in order to arrive at the causes of the idiosyncrasies of the individuals which it comprises, and with the reason why a certain aliment which is digested by some of them, is not digested by others ; but they are also connected with the botanical and zoological sciences with respect to the influence which the aliment may exert on the development of the individuals of a species, in order to constitute *varieties* or *races*. And when the incessantly increasing number of organised species is considered, we may be allowed to believe that one day some will be recognised which are only simple varieties of well circumscribed species, because their present distinction has been established only from a too small number of individuals, or from characters not sufficiently defined. It will, doubtless, be thought that one of the means of discovering them would consist in following in a series of individuals of successive generations, issues of the same seed or of the same mother, the influence of the same nourishment in circumstances defined, and as analogous as possible. Who would dare to assert, that this mode of experiment, now applicable to plants, would not hereafter be applied, with equal success, to animals ?

I think that I have demonstrated, that it is principally to chemistry that it belongs to explain the transformations to which organised beings subject the matter of the aliment which they derive from without in order to assimilate it ; and that many phenomena arising from these transformations may be referred to the physico-chemical sciences. I now enunciate this proposition with much less reserve than at the period when I wrote the reflections relative to the investigation

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* *Considérations générales sur l'Analyse Organique et sur ses Applications.* By M. Chevreul, Paris, 1824 ; chez Levrault. pp. 53 et seq. 190 et seq.

of the causes from which emanate the phenomena of life, which terminate my work on organic analysis; but, in making this avowal, I admit that all the phenomena of respiration, of circulation, of secretion, of digestion, and of assimilation, would be explained by the mechanical, physical, and chemical sciences, that, probably, we might not be more advanced by them than we are concerning the first cause of life; for, if these phenomena are really effects whose proximate causes belong to the sciences which we have just named, it is evident that there is a more general cause, whose effect, reduced to the most simple expression, is revealed in the progressive development of the germ and of the being which proceeds from it. And here I do not examine the question of the pre-existence of the germ or of its origin by epigenisis.

It is very effectively the power possessed by the germ of being gradually developed at the expense of the external world, in such a manner as to represent the being from which it emanates, and to reproduce individuals similar to itself; it is this power, I say, the origin of whose action escapes us, and is revealed to our senses only when the germ is already an organised being, which is the capital fact of organisation, the mystery of life; for the living being cannot be developed with the uniformity which we observe in its form and the functions of its organs, without a harmony being pre-established between all its parts and the external conditions in which its existence is possible; consequently, without all the forces to which we immediately refer all the phenomena of life, being balanced in their oppositions, co-ordinate in their successive acts, in such a manner as to unite for a common object. It is evident to me, that that which essentially distinguished the organised body from the crude body, is not the nature of the forces to which we immediately attribute the phenomena of life; but, indeed, the first cause of the mutual balancing of these forces and of their co-ordination to maintain life in an assemblage of molecules subjected to a determined form, susceptible of regular increase at the expense of the external world.

Finally, I have never perceived so clearly as now, how little reason there is to suppose that that which should explain digestion, assimilation, respiration, circulation, and secretion, would also explain life. This profession of faith will, doubtless, be sufficient to prevent any person from attributing to me the idea of having assimilated a stuff dyed with Prussian blue with an organised being, at the same time that the considerations which I have just enumerated, although quite speculative, will enable us to comprehend how far the physico-chemical sciences may be expected to elucidate the sciences of organisation.

INVESTIGATIONS CONCERNING THE METALLIC ACIDS.*

BY E. FREMY.

MEMOIR V.

I HAVE examined, in four memoirs which I have had the honor of presenting to the Academy (all of which have appeared in THE CHEMIST), the principal properties of the metallic acids formed by the common metals. I now make known the first results of my investigations concerning *osmium* and *iridium*. I will read only an extract of my memoir, in order not to occupy the time of the Academy.

These two metals, which, by their abundance in platinum ore, and the whole of their properties, may one day give rise to useful applications, have, hitherto been little studied. Berzelius says, indeed, in concluding his important memoir on osmium and iridium, that his investigations can be regarded only as a sketch of the long and difficult history of the metals which are associated with platinum.

I considered that, before studying the metallic acids formed by osmium and iridium, it was indispensable to undertake an entire examination of these two metals. The first part of the work which I now communicate, makes known the process which I have employed for obtaining, with facility, perfectly pure osmium and iridium. The second part will be devoted to the examination and to the analysis of the salts formed by these metals. The residues of the platinum ore with which I operated, were given to me by M. Desmoutis, manufacturer of platinum.

If osmium has hitherto been examined by only a few chemists, it is because this singular body, which resembles arsenic rather than platinum, to which, however, it is similar, under the influence of oxygen, forms a volatile acid, whose vapors, which are difficult to condense, exert a powerful action on the animal economy. Berzelius, in his memoir on osmium, states that he had at his disposal only about thirty grains of this metal.

I thought that the only means of making, without danger, complete investigations concerning osmium, was to engage it in crystalline and easily purified combinations.

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* *Comptes Rendus*, No. 4, January 22, 1844.

This object, I think, I have completely attained.

The iridium prepared by the process of Berzelius, was never completely freed from osmium, for this celebrated chemist said that iridium, heated in the air, always disengaged vapors of osmic acid. The iridium which I prepare is pure, and does not contain osmium.

The following is the process which I adopt for obtaining osmium and iridium :—

I mix, at first, 100 grammes of the residue of platinum ore with 300 grammes of nitre ; I introduce these two bodies into a large crucible, and I heat them for an hour to redness in a blast furnace. After this calcination, the mass is run on a platinum plate ; this operation should be performed in the air, and it is also indispensable to cover the face, for, without this precaution, the vapor of osmic acid would act powerfully on the skin.

During the calcination with nitre, a certain quantity of osmic acid is lost ; but I have ascertained that the proportion of this acid, which might be condensed, would not always compensate for the inconveniences of a calcination in a porcelain retort.

The decanted mass which contains the osmiate and iridiate of potassa, is treated in a retort with nitric acid, which disengages the osmic acid, which has been condensed in a concentrated solution of potassa.

The residue of this distillation is treated by water, which removes the nitre, and by hydrochloric acid, which dissolves the oxide of iridium.

The osmium is thus obtained in the form of osmiate of potassa, and the iridium in the state of iridiate of potassa.

I have ascertained that osmiate of potassa, by disengaging oxygen, or yielding it to other bodies, may easily be converted into a red salt, crystallising in beautiful octohedrons, which I call *osmite of potassa*. This salt contains, indeed, a less oxygenous acid than osmic acid, for it is decomposed, under the influence of the weak acids, into osmic acid and black deutoxide of osmium.

I ordinarily form osmite of potassa by pouring a small quantity of alcohol into the solution of osmiate of potassa ; the liquor is heated, acquiring a red tint, and deposits a crystalline powder of osmite of potassa : in this case, the osmium is often entirely precipitated from its solution. This salt may be washed with alcohol, which does not dissolve it, and may then be kept for any length of time, without alteration. It serves for the preparation of all the compounds of osmium.

If it be treated cold by a solution of sal-ammoniac, it is at once dissolved, and immediately decomposed, giving rise to a new yellow salt, sparingly soluble in cold water.

This salt, whose preparation is so easy, calcined in a current of hydrogen, gives perfectly pure osmium.

Osmiate of potassa, treated by hydrochloric acid, disengages osmic acid, and gives a chloride of osmium which, under the influence of sal-ammoniac, forms a red precipitate very sparingly soluble in water.

I here speak of this red salt, because it may be employed for preparing osmium ; for, by calcination, it gives this metal in the pure state, and because, it is afterwards formed in the preparation of iridium.

I think that these facts render the preparation of osmium and its salts easily executed.

In order to extract iridium, I treat the chloride of iridium, the preparation of which I have already pointed out, by sal-ammoniac ; a brown-red precipitate is formed, arising from the combinations of bichlorides of osmium and iridium, with sal-ammoniac.

I have, fortunately, found a very simple process, which has enabled me to separate these two double salts.

Sulphurous acid, by dechloridising the double salt of iridium, renders it very soluble in water, whilst the double salt of osmium undergoes no reduction. I therefore pass a current of sulphurous acid over the two double salts suspended in water, the iridium enters into solution, and the osmium remains precipitated in the state of a red salt.

Thus the separation of these two metals, which, by other processes, is always incomplete, is rendered very simple by the process which I have just described. The soluble salt of iridium crystallises in large brown prisms in solutions of sal-ammoniac. It is easy to purify it : when it is calcined in a current of hydrogen, it gives mere iridium, which, in this case, retains the crystalline form of the double salt.

The soluble salt of iridium is capable, under the influence of chlorine, of regenerating the insoluble black salt.

Such are the facts which I have to communicate to the Academy. In my next memoir, I shall have the honor of communicating to it the result of my investigations concerning the combinations of two metals, of which I think I have simplified the preparation and facilitated the study.

ON THE PRODUCTS OF THE DRY DISTILLATION OF THE SULPHOCYANIDES.*

BY C. GERHARDT.

The preparation of my *Précis de Chimie Organique*, furnished me with an opportunity of studying the interesting bodies which Liebig obtained in the dry distillation of the sulphocyanides. This study has led me to the discovery of several errors which have made their way into all chemical books, and which singularly embarrass the history of these bodies. You will see, however, that their numerous metamorphoses are very simple. When sulphocyamuret of mercury is distilled, sulphuret of carbon, and cinnabar, as well as the orange-colored body, to which Liebig has given the name of *mellon*, are produced. The latter contains C^3N^4. Völkel has disputed the accuracy of this formula, but it is impossible to substitute any other for it; you will perceive, moreover, the formation of mellon by other compounds, entirely agrees with Liebig's formula. The following is the mode by which mellon is derived from sulphocyamide of mercury :—

$$4CHg\,NS = CS^2 + 2Hg^2S + C^3N^4\dagger.$$

When we heat, in an oil-bath, the persulphohydrocyanic acid of Wöhler, $C^2H^3N^2S^3$, it is completely decomposed, producing sulphuret of carbon, sulphuretted hydrogen, and a residue from which a stronger heat expels sulphur, leaving a greyish body which contains mellon :—

$$2C^2H^2N^2S^3 = CS^2 + 2H^2S + C^3N^4 + S^2.$$

This mellon does not act the part of a radical, and dissolves in caustic potassa without disengaging hydrogen, and acetic acid precipitates from the solution, white flocks of the hydromellonic acid of Gmelin. But this acid contains oxygen as an integrant part. The mellonuret of lead, obtained by mixing the salt of potassa with nitrate of lead, contains $C^3(HPb)N^4O + 2Aq$, as Gmelin's analyses indicate. 14·5 per cent. of the water of crystallisation which this salt contains, may be expelled from it by dessiccation, but the dry salt is oxygenous. Moreover, it is impossible that it can be otherwise, for mellon directly fixes the elements of potassa (KH)O, as, for example, isatine does, in being converted into isatate, or camphor in being converted into the campholate of Delalande. We have, therefore—

Hydromellonic acid	$C^3H^2N^4O$.
Mellonuret of potassium..	$C^3(HK)N^4O$.
,, lead	$C^3(Pb)N^4O$.

Which proves, also, that hydromellonic acid does not possess the composition which the theory of radicals attributes to it, because this body gives, by heating in a glass tube, mellon and water, as well as hydrocyanate of ammonia, arising from a secondary action of the water on the elements of mellon. We have, therefore—

$$C^3H^2N^4O = C^3N^4 + H^2O.$$

You see, also, from the foregoing, that perfectly pure and dry mellon could not give a mellonuret by the action of potassium; for, where could the hydrogen, which the mellonuret of potassium contains, come from?

A boiling solution of potassa attacks mellon, disengaging ammonia, and converts it into a salt from which the acids precipitate cyanuric acid. This decomposition also results from the fixation of the elements of potassa or water ; for,

$$C^3N^4 + 3H^2O = NH^3 + C^3H^3N^3O^3,$$
$$C^3N^4 + 3(KH)O = NH^3 + C^3K^3N^3O^3.$$

Let us pass on to the dry distillation of sulphohydrocyanate of ammonia. This salt gives sulphuret of carbon, sulphuretted hydrogen, ammonia, and a greyish residue, to which Liebig gives the name of *melam*. This body, in my opinion, is only a mixture of mellon, and the alkaloïd called *melamine* by the celebrated chemist of Giessen ; it possesses all the characters proper to such a mixture. As melamine contains $C^3H^6N^6$, we have—

$$4CHNS,\quad NH^3 = CS^2 + 2H^2S + 2NH^3 + C^3H^6N^6.$$

The presence of mellon in this residue is explained, if we consider that mellamine itself is converted at a high heat into mellon and ammonia—

$$C^3H^6N^6 = 2NH^3 + C^3N^4.$$

Under the influence of the concentrated alkalis or acids, mellamine fixes the elements of water, eliminates ammonia, and is successively converted into *ammeline*, *ammelide* and *cyanuric acid* :—

$C^3H^6N^6 + H^2O = NH^3 + C^3H^5N^5O$ ammeline.

$C^3H^6N^6 + 2H^2O = 2NH^3 + C^3H^4N^4O^2$ ammelide.

$C^3H^6N^6 + 3H^2O = 3NH^3 + C^3H^3N^4O^3$ cyanuric acid.

Ammeline and ammelide themselves are finally converted into cyanuric acid. The formula which Liebig attributes to ammelide cannot be retained. By the action of heat, ammeline and ammelide furnish us with mellon ; we have, indeed—

$$C^3H^5N^5O = NH^3 + H^2O + C^3N^4$$
$$C^3H^4N^4O^4 = \quad 2H^2O + C^3N^4$$

Nothing is more simple than these metamorphoses ; the fixation or elimination of the elements of water is necessary, as in most organic reactions.

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* *Comptes Rendus*, No. 4, Jan. 22, 1844.

† C = 75, H = 6·25, N = 87·5. The oxides corresponding to water, H^2O are represented by $Pb,^2O$, $Hg,^2O$, Ag^2O.

But what renders Liebig's three alkaloïds still more interesting is, that they represent the *amides* corresponding to the three ammoniacal salts of cyanuric acid. The latter, as a tribasic acid, should combine with ammonia, giving :—

$C^3H^3N^3O^3$, NH^3 monobasic salt,
$C^3H^3N^3O^3$, $2NH^3$ bibasic salt,
$C^3H^3N^3O^3$, $3NH^3$ tribasic salt,

in the same manner as oxalic acid, which is bibasic, gives ammoniacal oxalate (called acid salt) and binammoniacal oxalate (called neutral salt). Now, it is known that these two oxalates are converted into amides eliminating the elements of water.

$C^2H^2O^4$, $NH^3—H^2O=M$. Balard's oxamic acid ;

$C^2H^2O^4$, $2NH^3—2H^2O=$the oxamide of M. Dumas.

By applying these equations to the three cyanurets, we have :—

$C^3H^3N^3O^3$, $NH^3—H^2O=C^3H^4N^4O^2$, ammelide.

$C^3H^3N^3O^3$, $2NH^3—2H^2O=C^3H^5N^5O$ ammeline.

$C^3H^3N^3O^3$, $3NH—^3H^3O=C^3H^6N^6$ mellamine.

The conversion of these three alkaloïds into ammonia and cyanuric acid, under the influence of the concentrated acids and alkalis, proves, as it seems to me, the correctness of my opinion. To adopt it, it is true, the hypothesis of amidogen for explaining the reactions, must be renounced, establishing equations like those which I have here given. Moreover, I have followed this course in my book, and everything inclines me to believe that it would advantageously replace the very vague and confused system which is based on hypothetical radicals.

ON ABSINTHIC ACID.*

BY M. ZWENGER.

According to M. Braconnot, the absinthium (*Artemisia absinthium L.*) contains a peculiar, uncrystallisable, deliquescent acid, whose ammoniacal salt crystallises in tetrahedral prisms; he called it *absinthic acid.*

To obtain this acid in the state of purity, an excess of a solution of acetate of lead is added to the decoction of absinthium (stems, leaves, and flowers); a voluminous, dirty-yellow precipitate is formed, and the supernatant liquor contains, in solution, a salt of lead which is very soluble in the free acid; the liquor is then neutralised by ammonia until it has only a feebly acid reaction. There is poured on the well-washed combination of lead, three or four times its bulk of water, and it is decomposed by sulphuretted hydrogen; it is then necessary that the phial which contains the salt of lead be always maintained at a temperature of 140° to 150°F. in order that its decomposition may be complete and easy. The liquor separated by filtration from the sulphuret of lead is again precipitated by acetate of lead, and the precipitate obtained is decomposed in the same manner. The filtered liquor is afterwards evaporated to a syrupy consistence, and the residue is treated by hot ether until there is no longer any acid reaction. The ether is removed by distillation, and water is poured on the remaining brown mass ; an acid resin is thus precipitated, which forms, after a short time, a compact deposit on the sides of the vessel; this resin is the bitter principle of absinthium. The aqueous solution, of a yellow color, gives crystals by concentration, which it is very difficult to purify by pressure between sheets of blotting paper and by several crystallisations. As the acid is volatile, this object is better attained by submitting the residue to dry distillation; by the addition of water, the greater part of the empyreumatic oil, which distils over at the same time, may be separated ; the crystals thus obtained may be more easily purified. Afterwards, when the author had better ascertained the nature of this acid, he purified it by nitric acid. The quantity which is thus obtained, is very small; 20 kilogrammes of dry absinthium gave barely 1 gramme of pure acid.

Pure absinthic acid has a sour but peculiar taste ; it is soluble in water, in alcohol, and in ether, and crystallises in small lamellæ, mixed, also, with prismatic needles ; it sublimes without residue; the vapors powerfully provoke coughing ; chlorine and nitric acid do not cause it to undergo any alteration. The solutions of the salts of lead and silver form a white precipitate with this acid, neutralised by ammonia ; a brown-red precipitate is obtained with chloride of iron ; the chlorides of barium and calcium and the salts of manganese do not form any precipitate in it.

I. 0·1725 gr. of acid dried at 212°F., gave 0·084 of water and 0·255 of carbonic acid.

II. 0·3335 gr. of acid gave 0·155 of water and 0·4923 of carbonic acid ; which gives, in 100 parts :—

	I.	II.
Carbon.....	40·650	40.591
Hydrogen....	5·409	5·151
Oxygen.....	53·041	54·258
	100·000	100·000

These numbers correspond with the following formula :—

* *Annalen der Chemie und Pharmacie.*

		In 100 parts.
4 atoms Carbon ..	303·416*	40·955
6 ,, Hydrogen	37·438	5·033
4 ,, Oxygen ..	400·000	53·992
	740·854	100·000

The formula of the salt of silver is:—

		In 100 parts.
4 atoms Carbon	303·416	14·587
4 ,, Hydrogen..	24·959	1·200
3 ,, Oxygen....	300·000	14·423
1 ,, Oxide of silver..	1461·610	69·790
	2079·985	100·000

The formula of the acid is, therefore, $C^4H^4O^3 + Ag$. and the equivalent calculated for the anhydrous acid = 627·37.

The numbers found, as well as the reactions of this acid, present, says the author, so perfect an accordance with those of succinic acid, that not the slightest doubt concerning their identity can exist.

Succinic acid is combined with potassa in the absinthium. If the extract of this plant be directly treated by ether, succinic acid is not obtained; but if it be submitted to dry distillation, the presence of succinic acid among the products of the distillation is manifestly recognised: it appears, therefore, that the succinic acid exists in the absinthium in the state of acid succinate of potassa; this salt has, indeed, the property of abandoning a portion of its acid unaltered by dry distillation.

ACTION OF CHLORINE ON CHROMATE OF POTASSA.†

BY E. FREMY.

In studying, in a general manner, the action of chlorine on the salts, I observed some new facts which I will first publish separately, and which will afterwards be contained in a work on the salts, with which I have long been occupied.

When neutral chromate of potassa is placed in a porcelain tube which is heated to redness, and when a current of dry chlorine is passed over the salt, the chlorine is entirely absorbed, and the chromate is immediately decomposed into chloride of potassium and oxide of chromium.

The oxide of chromium which is produced in this case, is always crystallised in large brilliant lamellæ.

The temperature at which the reaction is performed, is not without influence on the properties of the oxide of chromium. When the tube has been heated to dull redness, the oxide crystallises in large green lamellæ.

When the chlorine is passed over, when the tube is at a bright red, the oxide of chromium is always crystallised, but the crystals are no longer green and friable as in the former case; they are brown, very hard, and resemble those which are produced when bichromate of perchloride of chromium is passed into a red porcelain tube, according to Wöhler's ingenious process.

It is probable that the crystallisation of the oxide of chromium in the circumstances which I have just made known, is due to the presence of chloride of potassium. This crystallisation of oxide of chromium resembles that of the peroxide of iron which is produced by calcining sulphate of iron with common salt. The presence of a fusible salt appears to be favorable to the crystallisation of the metallic oxides. We are already acquainted with a great number of processes for preparing crystallised oxide of chromium; I think that that which I have indicated is as quick as the others, and that it gives large crystalline lamellæ.

When a mixture of chromate of potassa and charcoal is submitted to the action of chlorine at a high temperature, an hydrous chloride which is volatilised is obtained; there remains in the porcelain tubes a crystallised rose-colored salt which is a double chloride of chromium and potassium.

This salt is very deliquescent; it is decomposed in water into chloride of potassium and protochloride of chromium.

The production of this double salt is very remarkable, for this compound is probably formed only in these circumstances. It cannot be obtained in the humid way, because it is decomposed by water; and when a mixture of chloride of chromium and chloride of potassium is heated, the chloride of chromium is volatilised before combining.

ANALYSIS OF A POISON EMPLOYED BY THE NATIVES OF THE ENVIRONS OF CARACAS, SOUTH AMERICA.*

LETTER FROM M. PREDRONI TO M. DUMAS.

Relying on the extreme kindness with which you received my former letter, I beg that you will be kind enough to communicate to the Academy of Sciences the following note concerning a vegetable poison used

* The atomic weight of carbon = 75·85.

† *Journal de Pharmacie*, February, 1844.

* *Comptes Rendus*, No. 4, January 22, 1844.

by the Indians of the province of Caracas to poison their weapons. I regret only my inability to give a quantitative analysis of it, but I had so little of the matter at my disposal, that I could not repeat my experiments.

This poison was contained in a tooth. It is of the consistence of a solid extract, attracting moisture from the air, soluble in all proportions in water, with a greyish, pulverulent residue.

Aqueous solution, strongly colored of a deep brown.

Alcoholic solution, of the color of light bistre.

Ethereal solution, colorless.

By means of reagents I was able to recognise the presence of some principles, and I was able to isolate others, in such a manner as to leave no doubt of their existence, with the exception of one, brucia, which I mark with a note of interrogation.

The following is a table of the matter found :—

Fecula	In very large quantity.
Ligneous matter	A small portion.
Strychnia.....	Forming one-sixth of the mass.
Brucia ?	
Iron	In very large proportion, for a very abundant blue precipitate was obtained by means of ferrocyanide of potassium. Could it arise from the weapons poisoned with it ? or, rather, was not the extract evaporated in an iron vessel ?
Sulphate of potassa.	
Chloride of potassium.	
Resin.	
Water.	
Lime.	

A gramme of this matter burnt on a sheet of platinum, burned with a smoky empyreumatic and acrid flame, and I obtained about two centigrammes of ash, in which I detected the presence of lime.

Being desirous of ascertaining the energy of this poison, the following is what I observed :—

FIRST EXPERIMENT.

Having pricked a cat on the internal part of the right thigh, with a lancet steeped in the aqueous solution of this poison, the animal appeared, at the end of a few minutes, to have an uneasiness which went on increasing. Seven minutes after having been pricked, a violent fit of tetanus supervened, which lasted till its death, five minutes afterwards.

SECOND EXPERIMENT.

Having repeated the same experiment with a lancet steeped in the alcoholic solution, death occurred, with the same symptoms, eleven minutes after the animal had been pricked.

One phenomena which I have remarked is, that when an animal is poisoned with nux-vomica or strychnia, the attacks of tetanus are intermittent, whilst, in the foregoing experiments, the tetanus lasted until death, from the time of its commencement.

The above are the results at which I have arrived. With respect to the plant or plants which the Indians use for preparing this matter I have been unable to procure any data concerning them ; for, as you know, these people are very secret with regard to preparations of this nature.

INVESTIGATIONS CONCERNING THE CARBONATES OF COPPER.*

BY M. P. A. FAVRE.

The carbonate of copper dissolved in sesquicarbonate of ammonia, and the solution is of a beautiful blue ; this fact is perfectly known; but what is the combination which is produced ? It is indicated only hypothetically. I have obtained a well-crystallised product, whose analysis, and various modes of alteration, I now give.

The blue solution, thoroughly concentrated, and well saturated with carbonate of ammonia, is diluted with twice its bulk of alcohol ; as takes place in the ordinary circumstances of a solution of sesquicarbonate, crystals of bicarbonate are not deposited, and, after twelve hours, the liquid being decanted, the sides of the vessel are covered with large and beautiful crystals, and sometimes with needles not less than 5 centimetres in length ; these crystals have a very intense blue color, analogous to that of the carbonate of Chessy ; they present a purple tint by transmitted light.

* *Annales de Chimie et de Physique*, Jan. 1844.

	Analyses.				Theory.
Cu O..	50·47*	50·33†	50·49‡	0§	50·41
H ..	"	"	"	3·97	3·81
N ..	"	"	"	18·20	17·79

Its formula—

$$CuH^3NO, CO^2$$

This salt is a carbonate of oxide of cuprammonium ; regarding it in this point of view, $CuOCO^2H^2N$, the ammonia acting the part of water, it would correspond to a carbonate of copper, which is not known, and we should thus arrive at the only possible explanation of the ammoniacal carbonate of zinc, whose analysis I have given, and whose formula, I think, can only be as follows :—$ZnO, CO^2\ ZnH^3NO, CO^2$. This salt is rapidly destroyed by water ; in this case, the water takes up carbonate of ammonia, dissolves a portion of carbonate of copper, by aid of this salt, and there remains carbonate of copper 2 CuO, CO^2, 2HO, to which we shall return further on. Water charged with carbonate of ammonia dissolves it without residue ; it is therefore impossible, according to what we have just said, to crystallise it in water ; it is completely insoluble in alcohol and in ether, and does not undergo any alteration in them. Also, in order to avoid all alteration of the crystals, after having decanted the liquor in which they are formed, and, after having collected them at the bottom of the vessels, they must be washed with alcohol and dried rapidly in the air. Notwithstanding this rapid altèration of the crystals by water, they are formed in abundance in the filter through which the blue liquor has been strained, and on which there remains carbonate of copper and carbonate of ammonia, undissolved; they may also be produced, but in small crystalline grains, by a simple digestion of carbonate of copper, and carbonate of ammonia in alcohol ; finally, it may be obtained, but in the pulverulent state, by mixing the cupreous and ammoniacal salts, in the dry state, and submitting them to a temperature of 212°F. ; the mixture fuses, loses its water and the excess of ammoniacal salt, then again becomes solid with a beautiful and very intense blue color.

Heat acts on this salt in the following manner :—Heated to 392° F., in a current of carbonic acid, carbonate of ammonia is sublimed ; a portion of oxide of copper is reduced. The sublimed carbonate gave the following numbers :—

(*) CO^2 .. 51·17
H^2 N.. 40·29
HO .. 8·64

It is evident that this carbonate is anhydrous, for the water found by analysis is not only not sufficient for forming the hydrated carbonate of ammonia, but also the partial reduction of the carbonate of copper gives it as an accident of the operation, for 0·371 of the black residue obtained by heat, gave me 0·058 of metallic copper. I ascertained that it was not an amidide. This operation proves, besides the anhydrous state of the salt of copper, how easily the oxide of copper may be reduced at a low temperature by reducing bodies in the nascent state. Submitted rapidly to a more elevated temperature, this salt is decomposed with a vivid deflagration ; and if the operation be performed in a current of carbonic acid, the residue of the operation is metallic copper : the oxide of copper was completely reduced. This property requires peculiar precautions during the analysis for estimating either the oxide of copper or the other elements ; this salt is slowly altered in the air.

The liquor from which the crystals abandoned to the air deposits a crystalline crust of a bluish green. This carbonate possesses the following composition :—

	(1)	(2)	(3)	(4)	(5)	Theory.
Cu O....	66·49	66·54	66·20	66·07	66·56	66·66
H O....	14·87	,,	,,	15·23	14·77	15·00

Formula..... 2 Cu O, CO^2 2 HO.

The oxide of copper arising from the calcination is brilliant and in crystalline laminæ. It is, therefore, the green carbonate analysed by Berzelius, plus 1 equivalent of water. Moreover, by precipitating the carbonate of copper without heat, as that chemist has observed, this salt is blue, and differs from the green obtained by heat only in the greater quantity of water. I wished to ascertain whether the quantity of water in excess could be well defined ; for that purpose I precipi-

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* 1 gr. 365 of matter gave 0·688 Cu O.
† 2 " 400 " 1·208.
‡ 1 " 014 " 0·512.
§ 1 " 008 " 0·361 HO.

158 cubic centimetres N^3, temperature 64° F., pressure Om 7584.

(*) 01 gr. 611 of matter, gave 0·442 of water.

172 cubic centimetres N temperature 60·8 F., pressure 0m 7610.

(1) Matter 1 gr. 131 = 0·752 Cu O.
,, 1 ,, 978 = 0·294 H O.
(2) ,, 1 ,, 082 = 0·720 Cu O.
(3) ,, 2 ,, 098 = 1·389 Cu O.
(4) ,, 1 ,, 574 = 1·040 Cu O.
,, 1 ,, 378 = 0·210 H O.
(5) ,, 1 ,, 896 = 1·262 Cu O.
,, 1 ,, 537 = 0·227 H O.

tated, without heat, some carbonate of copper, which I washed without heat and placed on two filters; the one, humid, was submitted to a sand-bath heat, and rapidly passed from blue to pear-green, becoming pulverulent. Analysis gave the numbers of Berzelius. The other, compressed, was dried in the air, and remained blue; afterwards dried at a temperature of from 122° to 140° F., the analysis gave me 61·86, 63·18, and 62·39 per cent. of oxide of copper: these numbers approach those given by the formula 2 Cu O CO^2 3 HO. Dried at 230° F., it again loses water, and the following analysis gives it the formula 2 Cu O CO^2 2 HO.

	(1)	(2)	(3)	Theory.
Cu O	66·72	66·45	67·12	66·66
H O	15·08	14·89	14·92	15·00

It therefore appears well demonstated that the carbonate of copper precipitated without heat, dried in the air, presents a very stable constitution, whilst it is sufficient, in presence of water of the temperature of 194° F., to make it lose 1 equivalent of water; but, dried and submitted to 230° F., it keeps this equivalent, and loses it, as we shall see farther on, only by losing carbonic acid.

If we dilute with a great quantity of water the same blue liquor which deposited the crystals of ammoniacal carbonate of copper, a blue salt is precipitated, which presents a very different composition; it is blue from the time of its precipitation, and when it is simply dried in the air from 122° to 140° F., it seems to contain more water than when it is dried at 230° F.; indeed, for the four different products I obtained:—First, 70·35 Cu O, 13·05 CO^2; second, 68·91 Cu O, 12·54 CO^2; third, 70·62; fourth, 69·6. These numbers agree very well with the formula 3 Cu O CO^2 3 HO; but dried at 230° F., it acquires the green tint of acetate of copper, and its composition is constant. The following numbers lead to the formula 3 Cu O CO^2 2 HO.

	(1)*	(2)*	(3)*	(4)*	Theory.
CuO..	75·76	75·08	75·51	74·98	75·00
HO ..	12·98	,,	11·30	11·34	11·25

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(1)	Matter	1 gr.	802=1·202	Cu O.
	,,	1 ,,	412=0·213	H O.
(2)	,,	2 ,,	101=1·396	Cu O.
	,,	1 ,,	857=0·277	H O.
(3)	,,	1 ,,	771=1·188	Cu O.
		1 ,,	251=0·187	H O.
(1)*	Matter	2 gr.	111=1·599	Cu O.
	,,	1 ,,	543=0·200	H O.
(2)*	,,	1 ,,	752=1·315	Cu O.
(3)*	,,	2 ,,	112=1·595	Cu O.
	,,	3 ,,	213=0·363	H O.
(4)*	,,	2 ,,	198=1·648	Cu O.
		1 ,,	351=0·153	H O.

This salt has therefore the same formula, as that of the carbonate of Chessy:—

3 Cu O 2 CO^2 HO
3 Cu O 2 HO CO^2

The water replacing the carbonic acid, and *vice versâ*.

ACTION OF HEAT ON THE HYDRATES AND CARBONATES OF COPPER.

I have analysed all the products which I submitted to the action of heat; they are the following:—

	Decomposed at.
Cu O HO.....	Hydrate of copper.... 302°F.
2 Cu O C O2 H O	Pear-green carbonate..356°F.
	malachite..518°F.
2 Cu O CO^2 2HO.....	366°F.
2 Cu O CO^2 2HO.....	230°F. loses HO
3 Cu O 2CO^2 HO	Blue ash...410°F.
	Chessy....518°F. loses O
3 Cu O2 HO CO2.....	338°F.
3 Cu O3 H O CO^2.....	230°F. loses HO

According to this table, it is evident that the presence of water lowers the point of decomposition of the salts; but the departure of water is always accompanied with that of carbonic acid; for each of these products, analysed in different phases of their decomposition, has always shown the constancy of this simultaneous departure. Water and carbonic acid differ, therefore, very little in their power of affinity in presence of oxide of copper: it is evident, moreover, that the artificial carbonates present less stability. If, now, we seek to account for this multiplicity of the carbonates of copper, it will be easily explained when we take into consideration the very feeble affinities of their constituent elements. The oxide of copper on one hand, and on the other especially, the carbonic acid and water, which, from their almost equal affinity, require only very feeble variable circumstances to partake differently the base which is delivered to this affinity: if, again, we regard the ammoniacal carbonate, we shall find many more of them, and this seems to be easily explained; for the latter, the conditions are more favorable; for, besides the solvents at a favorable temperature, and of a different nature, in which they may be produced, conditions attainable for the carbonates of copper, their solubility and the volability of all their elements present new facilities for the production of more numerous compounds; it is based on this resemblance that I consider these investigations as possessing some interest.

A FEW WORDS ON PECTIC ACID.*

BY FROMBERG.

Fromberg has adopted, from analytical investigations, the following formula for the composition of pectic acid:—

	Calculated.
C^{12}	45·48
H^{16}	4·95
O^{10}	49·57

He thinks that the quantities of carbon found by MM. Frémy and Regnault are too small; and that the formula C^{24} H^{34} O^{22}, deduced from their analysis, is not correct.

His investigations have, however, in general, confirmed the observations of M. Frémy relative to the alterations which pectic acid undergoes by boiling with water, and by the action of acids and alkalies. He has found, more than once, after prolonged boiling with a feebly alkaline liquor, that no precipitate was formed by the addition of an acid: metapectic acid, which is soluble in the acids, was produced.

Fromberg announces that he is engaged with investigations concerning this modification of pectic acid, which Frémy has called matapectic acid, as well as concerning the other alterations which pectic acid undergoes in different circumstances: he proposes to publish them at a future period.

*Annalen der Chemie und Pharmacie, Vol. xlviii.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

THE OPERATION OF EXCISE RESTRICTIONS UPON THE PROGRESS OF CHEMICAL SCIENCE AS APPLIED TO THE ARTS AND MANUFACTURES OF THIS COUNTRY.

LETTER III.

To the Editors of the Chemist.

Gentlemen,—

Before I proceed with my subject, allow me to apologise for not having been able, owing to an unusual pressure of business, to prepare this paper for last month's publication.

To prove the proposition with which I commenced these papers—that the progress of chemical discovery is retarded in those branches of manufactures which are subject to the withering influence of the Excise laws,—I will direct the attention of your readers to the state of those staple branches of industry still subject to the Excise—to the progress of those which have been recently released from Excise interference, and then to the wonderful degree of perfection of every process, whether mechanical or chemical, connected with other manufactures which have never been conducted under legal rules, or in prosecuting which the intelligence of the manufacturer has not been paralysed by competition with fraud and dishonesty.

We should be charged with exaggeration in our statements, had we not, very fortunately, authentic public documents to refer to, and from them alone we shall collect sufficient information for our present purpose.

The following observation occurs in the 17th Report of the Commissioners of Excise Inquiry, which of itself is almost sufficient to prove our case. "The observations we have made in our report on Glass, with respect to the mischievous effects produced by the interference of the Excise, with the process of that manufacture, apply with equal force to the regulations affecting the manufacture of soap.

"It will be seen on a perusal of the evidence that these branches of national industry which ought to have been advanced by the numerous important improvements introduced by modern discoveries in Chemistry, are strictly confined by the existing laws, to one process, to one period of time, and to one proportion of produce from materials however dissimilar and however uncertain in the amount which they yield."

Soap.—Evidence of Mr. Fareham—"The manufacture is more advanced in France, in Spain, and even in Corfu, than in England, in consequence of its being free from Excise restrictions."

Again, Mr. Tennant, of Glasgow, says, in reply to the inquiry—"Do you find the Excise regulations in your way in introducing improvements?" A very great obstruction as they admit of no experiments on a large scale. The very existence of inspection, calculated to carry away our improvements, necessarily tends to check all improvements." "Are you of opinion considerable improvements might be made? I am quite confident the manufacture of soap is subject to great

improvement. It is altogether a chemical process."

To prove the injurious effect of these restrictions, by the improvement and economy introduced into the operation of calico printing immediately after the repeal of the duty, we will quote the evidence of one of the Manchester deputation, who says in reply to the inquiry of the Commissioners, as to the result of that repeal on consumption, that as an instance of the beneficial effect to the manufacturer and the public, a friend of mine has printed double the quantity of goods that he did previously to the repeal of the duty, without additional labor, or enlargement of his works, and this may be said to be generally the case.

These extracts might be continued to almost any extent, but we have quoted sufficient for our present purpose, especially as it is the evidence of manufacturers who have distinguished themselves by the introduction of great improvements in other chemical manufactures in which they are engaged.

The manufactures referred to in these extracts, remain to the present day in the state they were when the Commission, from whose reports we have made our extracts, was sitting.

The amount of some of the duties has been reduced, but the regulations, from the extensive frauds which that Commission exposed, have been rendered more efficient for the collection of the revenue, and, therefore, more severe and harassing to the honest manufacturer.

The evidence clearly proves the proposition we started with: the difficulties thrown in the way of experiments by the Excise, and the certainty that if they were made, the results would be communicated to rival manufacturers, thus depriving the experimental chemist, even when successful, of the reward due to him for the time he has devoted to his profession, and for the labor imposed upon him in the practical application of the results of his study.

Compare, then, the present state of the manufactures of glass, paper, and soap, with those of candles, printed calicoes, stained paper, &c., &c., from each of which the Excise Law has been repealed.

In 1834, the year in which the candle duty was repealed, no variety of tallow candles was known except the ordinary dipped candles and the common mould; and for those whose wealth enabled them to discard such unpleasant means of illumination, wax and sperm candles were the alternatives, at a price from four to six times that of the tallow candle.

In the ten years which have just passed, three or four times as many patents have been taken out for improved modes of making candles. Machinery, heretofore unknown in candle making, has been introduced, and that manufacture, which was then carried on mostly in cellars, is now conducted with all the economy and skill invariably resulting from the application of capital employed in large manufactories; and in the progress of these improvements, whether mechanical or chemical, large sums have been paid to inventors by the manufacturers who have adopted them. Let us mark the progress of these improvements.

First, then, as to common, or dipped candles. The first improvement was the invention of a machine to cut the wicks. This machine, however, was in advance of the trade, for few makers, during the existence of the duty, made enough to make it profitable to employ a machine. Now, this machine, a little improved, is in general use, and enables one man easily to perform the labor of eight or ten working by hand.

The next step was to lessen the expense of making the candles; and for this purpose a machine was invented, and is now employed in all large works, by which, when the cottons are cut, one man can do the ordinary work of four; and upon this there are several patented improvements, by which the poor are supplied with candles at a very reduced price and of better quality.

Then followed Morgan's ingenious machine for making mould candles, whereby the labor and waste in making this description of candle, has been very materially lessened, and a better candle produced.

This machine offered great facilities for improvement in the wick of tallow candles, and in a short time several patents were taken out for wicks to burn without snuffing, one of which, Kempton's, bids fair to make such candles as perfect as the materials will admit of.

In candles of a better description the improvements have been as rapid and of more importance.

We are indebted to the French chemists, Gay Lusac, Thenard, and Chevreul, for the experiments, upon which all subsequent discoveries and improvements have been based. Many years before the repeal of the duty on candles, they accomplished the separation of the fatty acids. Their knowledge was disseminated in England, but not practically applied till eight or nine years since, some little time after the trade was free. Then one step led to another with great rapidity, and wax and spermaceti candles are now almost driven out of the market; and a beautiful candle to burn without snuffing, varying in price from 1s. to 1s. 2d. per lb., has been brought into general use.

The progress of these improvements have been so rapid, and the public, in quality and price, have been so decidedly benefited by them, that it will perhaps be difficult to illustrate my subject more forcibly. There are points, however, connected with calico printing to which I will refer in my next paper, having now, I fear, trespassed too much on your valuable columns.

I am, Gentlemen,

Your obedient servant,

H.

ON THE VARIOUS METHODS OF ACIDIMETRY.

BY CHARLES WATT, JUN.

Numerous methods have from time to time been proposed and practised for determining the commercial value of acids, *i. e.* the per centage amount of real acid which they contain; but the one which has been most extensively used, and which I shall first notice, is that of ascertaining it by their specific gravity, which has simplicity for its greatest recommendation. But it happens, unfortunately, that we may be as easily deceived, if we rely upon the guide of specific gravity for a knowledge of the amount of real acid contained by those acids met with in commerce, by the parties who deal in them, adding to them small portions of saline matters, and thus increasing their specific gravity.

In cases where we have *pure* concentrated acids, such as the sulphuric, hydrochloric or nitric, we may learn their per centage of real acid, by determining with proper caution their specific gravity, without very considerable inaccuracy, and very useful tables have been constructed by several industrious chemists to save the trouble of calculation; but when we desire to know the amount of real acid contained by dilute acids, especially when they are contaminated by soluble impurities, the determination by specific gravity is entirely inadmissible. Whenever it is possible to adopt any other means of determining the commercial value of an acid, even should it be uncontaminated with fixed impurities, which is rarely the case, and concentrated, than that of specific gravity, I would recommend the latter not to be used, as there are so many little circumstances which affect the accuracy of the result, such as the inaccuracy of the instruments sold for the purpose, and the effects of variations of temperature, &c. &c. Most of the chemical methods which have been employed for determining the commercial value of acids, are similar to those which have been employed for testing alkalis, and are for the most part liable to the objections which I pointed out whilst treating of that subject. That method in which an alkaline test liquor is employed by *measure* to neutralize a given *bulk* of the acid is liable to the objections which attach to measuring in a two-fold degree: thus there are the inaccuracies attendant on the measure of the alkaline test liquor, and those attending the measuring of the acid, whose strength we wish to determine.

I have heard it observed, by parties who sometimes make these examinations for the markets, that it is "understood" that a certain method or instrument is referred to by the buyer and seller, and that this is fair, however inaccurate, because they are aware of what instrument is used. But the chemist has nothing whatever to do with any such understandings; his proper province is to make the examination with the greatest possible accuracy, employing as the basis of his calculations those equivalents which are adopted among *scientific* chemists, and bringing to bear upon the subject those improvements and corrections, which the latter have made from time to time.

It has also been the custom with some to determine the commercial value of dilute acids, such as the acetic, by ascertaining how much pure carbonate of lime such acids will dissolve; but this method has many objections, one of the chief of which is, the slowness with which the *complete* saturation of the acid is effected, unless heat be applied, which at the same time tends, when the acid is a volatile one, to render the results unworthy of confidence; and unless heat be applied, the liberated carbonic acid dissolves a portion of the carbonate of lime unacted upon by the acid under examination, and thus renders it difficult, if not impossible, to obtain correct results by such means.

A method somewhat modified, but not entirely new, has lately been proposed by Drs. Will and Fresenius, of Giessen, in a work quoted from in my article on alkaline here. I now extract from the same work a description of this system of ascertaining the commercial value of acids, to render it more thoroughly understood by the readers of this Journal:—

"The method which we suggest for the examination of acids, as to their per centage amount of anhydrous acid, is based upon a principle completely different from that which forms the foundation of the methods hitherto pursued. It rests upon the determination of the amount of carbonic acid expelled by a weighed quantity of the acid under examination; it may be employed for the determination of all acids which decompose carbonate of soda completely, no matter whether they contain salts or organic substances in solution; its execution is, if possible, even more

simple than that of our alkalimetrical method; its correctness we intend to prove by figures. It has, however, *one* defect in common with other acidimetrical methods, viz., free sulphuric acid, if contained in vinegar, is mistaken for acetic acid; hydrochloric acid, when contained in nitric acid, for nitric acid.* The usual qualitative tests as to the purity of the acids, must, therefore, as a matter of course, precede the application of our method.

"The operation for determining the amount of carbonic acid expelled, is conducted in the alkalimetrical apparatus described at Section 3. A flask, of a capacity of at least three ounces, should be selected for A.†; its aperture, though as wide as possible, yet must be perfectly round.

"Besides the apparatus, a little glass tube is required, and, moreover, some carbonate of soda.

"The little tube (*vide* Sketch) is made best by filing off the posterior end of a narrow test cylinder; it must hold from four to five grammes of bicarbonate of soda; and its width and length must be such as to admit its passing easily through the neck of A., and assuming a horizontal position on the bottom of A.

"It is not necessary that the bicarbonate of soda should be absolutely pure, *i. e.*, perfectly free from any admixture of sulphate of soda and chloride of sodium; and its being dry or moist, is also a matter of indifference. One condition, however, is indispensable for a successful and correct examination; viz., it must contain no neutral carbonate nor sesquicarbonate of soda. It must, therefore, be carefully tested for the presence of those two substances.

"For pharmaceutical purposes, the bicarbonate of soda is tested by adding to its solution, solution of perchloride of mercury: it is declared pure if it becomes merely turbid and milky at first. This method of testing is by no means very accurate, as may easily be proved by adding some neutral carbonate of soda to the bicarbonate under examination, and then testing with perchloride of mercury. The solution will always, at first, only become turbid and milky, if the neutral carbonate of soda has not been added to some extent. This reaction, therefore, cannot be relied upon. The safest way is to purify the bicarbonate of soda of commerce.* For this purpose, half a pound to one pound of it is reduced to an uniform powder, and a portion of it first tested with perchloride of mercury; if the result be satisfactory, the powder is put into a glass jar and covered with the same amount of cold rain-water; it is then allowed to stand for twenty-four hours, with frequent stirring; the salt is then placed upon a funnel, the tube of which is stopped with loose cotton, so as to allow the ley to drop off; the salt is then washed several times with small quantities of cold rain-water. The bicarbonate of soda, after its operation, generally is pure, and adapted for acidimetrical purposes. It is dried between some sheets of blotting-paper, without the aid of heat, and kept for use in a well-closed glass jar.

"It is, however, advisable to test its purity previous to using it; for this purpose, a portion (about four grammes) is directly treated as directed at Section 7 (*Alkalimetry*), to determine its amount of carbonic acid; another portion of four grammes is put into a porcelain or platina basin or crucible, and gradually heated to redness over a spirit-lamp; the basin (or crucible) is then weighed whilst still containing the residuary salt; this is removed, and the empty basin weighed again: this is the best manner of accurately determining the weight of the residue. If the amount of the residue bears to that of the carbonic acid found in the first portion, the exact, or, at least, approximate, proportion of 666·550, the bicarbonate of soda may be considered well adapted for the intended purpose. When testing bicarbonate of potash in the same manner, the relative proportion of the residue to the carbonic acid expelled must be like 865·550.

"The operation is conducted as follows:—

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* "Contamination of vinegar with other acids and especially with sulphuric acid, occurs less frequently now than was formerly the case. Most sorts of vinegar considered pure contain traces of sulphates in admixture, but never free sulphuric acid. This latter substance may easily be detected by mixing from one to two ounces of the suspected vinegar with a few pieces of white sugar, and gradually evaporating in a porcelain plate, taking always care to prevent the fluid from boiling. If the vinegar contains the slightest trace of free sulphuric acid in admixture, the residue will assume a jet black color as soon as it begins to dry. With pure vinegar this is not the case."

† See the Sketch given in The Chemist, for February, 1844.

* Bicarbonate of potash may be substituted for bicarbonate of soda; the latter is, however, cheaper; and, moreover, evolves a larger amount of carbonic acid.

A determinate amount of the acid under examination is accurately weighted into A., p. 16 (for the best method of weighing, we refer to Section 7, and for the quantities of the various acids best adapted for the purpose of examination, to Section 29). If we have concentrated acids to operate upon, from four to eight times their amount of water is added, according to their degree of concentration. The little glass tube is then filled nearly to the brim with bicarbonate of soda; a silk thread is tied round the tube, near its aperture, and the tube then lowered down into A, so as to remain perpendicularly suspended, upon A being closed (the silk thread becoming fixed between the cork and the glass). The rest of the apparatus is prepared exactly as Section 3 directs. This apparatus is then accurately weighed (Section 13); previous to this, the fluid in A must be allowed to cool completely, should it have become hot by mixing of a concentrated acid with the water; the cork of A is then slightly loosened, so as to allow the little tube, together with its silk thread, to fall into the acid, and immediately fixed again. The evolution of the carbonic acid begins instantaneously, and continues in a uniform and uninterrupted manner till the acid is completely neutralized. No aid is necessary; the operation may, however, be accelerated by repeatedly shaking the apparatus. When the operation is completed, *i. e.* when no more bubbles of gas appear upon agitating the apparatus (even very dilute vinegar does not require more than an hour's time), the flask A is placed up to its neck in a glass or a small jar, containing hot water, and left there until the renewed evolution of gas has completely ceased: this is also promoted by agitating the apparatus. The little wax stopper is then taken off from the tube *a* (if this were neglected, the sulphuric acid would recede, upon the apparatus being removed from the hot water), and the apparatus taken out of the hot water, wiped dry, and suction applied to D., until the sucked air has no longer any taste of carbonic acid.

"The apparatus, after having been allowed completely to cool, and having been carefully wiped dry again, is replaced on the balance, the other scale still containing the original weights, and weights are substituted for the loss of carbonic acid. The amount of anhydrous acid contained in the hydrated acid under examination is determined from the amount of carbonic acid escaped as follows:—

"Two measures of carbonic acid bear the same proportion to one measure of the anhydrous acid in question, as the amount of carbonic acid expelled does to the amount sought of anhydrous acid. Thus, let us suppose, for instance, we had examined dilute sulphuric acid and obtained 1·5 grammes of carbonic acid, the arrangement would be:— $550(2\times275) : 501 = 1{\cdot}5 : x$

$$x—1{\cdot}36.$$

"The amount of sulphuric acid operated upon, consequently, would contain 1·36 grammes of anhydrous acid. Let us suppose the weight of this amount to have been 15 grammes, the sulphuric acid under examination would contain a per centage amount of 9·06; for—

$$15 : 1{\cdot}36 = 100 : x$$
$$x = 9{\cdot}06.$$

"To render, however, calculation altogether unnecessary, we shall subjoin (at Section 29) the quantities which must be taken of the various acids, in order to determine immediately, from the amount of the carbonic acid, the per centage amount of anhydrous acid contained in the acid under examination.

"Neutral carbonate of soda cannot be substituted for bicarbonate, as it would give rise to the formation of bicarbonate in the course of the operation; and thus a comparatively far inferior amount of carbonic acid would be obtained, the solution of bicarbonate of soda not completely yielding its second combining measure of carbonic acid, even though the fluid be boiled for a considerable time. Bicarbonate of soda offers, moreover, the essential advantage of yielding two eqs. of carbonic acid for every eq. of acid, and thus doubling the difference of the weight of the apparatus before and after the operation, a circumstance which essentially contributes to the correctness of the results, rendering any error in weighing of less importance.

"The application of heat after the completion of the operation is indispensable; if it were neglected, from twenty-five to thirty milligrammes less of carbonic acid would be obtained.*

"That all carbonic acid is expelled from A. by the application of heat, and by sucking the air from *d*, may easily be proved by accurately weighing the apparatus after this operation, then applying heat and suction again, and weighing a second time. Only a very minute diminution of weight will be found the second time, varying from one to

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* 6·377 grammes of dilute sulphuric acid, yielded without the application of heat 1·540; after the application of heat, 1·570 grammes of carbonic acid; and in a second experiment, without the application of heat, 1·56; and after the application of heat, 1·58. Repeated experiments proved this proportion to remain always the same.

ten milligrammes (according to our own experiments). This fact proves at the same time, that by these operations no carbonic acid, at least not to any perceptible amount, is carried away from the fluid remaining in A. (which must be considered as a solution of bicarbonated alkali). The sucking must, however, be conducted very slowly, or else drops of the fluid, containing bicarbonated alkali, would be carried away into B., and lose their carbonic acid upon coming into contact with the sulphuric acid, and this of course would cause a greater loss of weight in the apparatus.

"The quantity of the bicarbonated alkali used must always be more than sufficient to saturate the acid under examination; the fluid in A. should be tested with litmus paper after the completion of the operation. This test, however, is in most cases unnecessary, since undissolved bicarbonate of soda usually remains in the little tube. Although it would be difficult to give any universal rule as to the amount of acid to be employed in every individual case, so as to leave always a surplus of bicarbonate of soda in the little tube, yet a mere superficial calculation, according to the degrees of concentration of the acid under examination, will at once point out this relative proportion between the acid and the bicarbonate of soda, and this the more readily, as an excess of bicarbonate of soda does not by any means interfere with the correctness of the results.

"Should a strip of litmus paper still be reddened, upon being thrown into A., after the completion of the operation, it would be necessary to fill a second tube with bicarbonate of soda, to weigh it accurately, and to add its weight to that of the apparatus, and then to drop it directly into A. The rest of the operation will be same as before."

To this method of ascertaining the per centage amount of real acid in the acids of commerce, there are objections, nevertheless, by the employment of extreme caution and skill in the manipulation, far more, I fear, than is at the command of those into whose hands this work is expected to fall, namely, manufacturers and their firemen. It is susceptible of much greater accuracy than when applied to the determination of the commercial value of alkalies. It would be useless here to repeat the objections which attach to this method of acidimetry, as they are of a similar character to those pointed out when treating of the application of this method of alkalimetry, with the exception, that, by the use of a bicarbonated alkali, as the substance from which to evolve the carbonic acid, so great an error is not likely to occur in ascertaining its precise amount, or, should it occur, it will not cause so much inaccuracy in the results.

It now remains for me to describe those methods of acidimetry which I have employed, and which I have found, from considerable experience, to be capable of affording results upon which the most implicit reliance may be placed. These are two in number: the first I usually apply to find acids, namely, those which are not volatile at any temperature under the boiling point of water; and the other to those which are volatile below that temperature.

The first consists in taking pure crystallised carbonate of soda, prepared by recrystallising several times in distilled water the crystallised soda of commerce, evaporating all their water, and subjecting the mass to a dull red heat; the product is pure anhydrous carbonate of soda, freed from sulphate of soda, and chloride of sodium (if the crystals have been carefully prepared), containing 58·6 per cent. of real alkali. A certain *weight* of this carbonate of soda may be deposited in a given *weight* of distilled water, and used by *weight*, as directed in my paper on alkalimetry, when treating of the test of sulphuric acid.

The operation is conducted as follows:— Weigh out the quantity of the acid whose strength it is desired to determine. If the acid be a concentrated one, dilute it with three or four times its bulk of water, then balance a bottle full of the test alkali, and having added a few drops of litmus to the acid, add successive portions of the alkaline liquor until the point of saturation is approached; if the acid be a fixed one, heat may now be applied, and the operation carefully finished by adding drops of the test liquor until the exact point of neutralization is arrived at; the bottle which contained the test alkali is then returned to the scale, and the amount of its contents used ascertained, and having a knowledge of the exact amount of alkali which it contains, a simple calculation will give the quantity of acid contained by the sample tested.

The second method, which I also frequently employ for determining the per centage amount of real acid contained by the volatile and dilute acids of commerce, consists in saturating such acids with a solution of pure ammonia; in adding an excess of ammonia, then boiling until all the excess of ammonia is driven off. The solution is then placed in a Florence flask, and caustic concentrated solution of alkali added to entirely decompose the ammoniacal salt formed; heat is then applied, and the ammonia, as it is evolved, conducted into a solution of the bichloride of platinum in ether, previously acidulated with muriatic acid; from the

quantity of the salt precipitated, we may calculate the quantity of ammonia which it contains, and, consequently, the quantity of real acid which the sample under examination contains.

ON THE APPROPRIATION OR DISTRIBUTION OF LANDS.

BY PROFESSOR LIEBIG.*

How is it possible, it may be asked, that there could ever be any doubt as to the part which the soil and its principles perform in the development of vegetables? or that the mineral principles of the plant could ever be regarded as neither necessary nor essential?

There has also been observed on the surface of the earth the same circulation, a continual exchange—a perpetual disturbance and restitution of equilibrium. The observations in agriculture show that the augmentation of vegetable substances, on a given surface, increases with the introduction of certain bodies which *were originally principles of the same surface of land*, which the plant has removed from it; the excrements of man and animals proceed from plants; and these are precisely the substances which in the vital act of the animal, or after its death, resume the form which they possessed as principles of the soil.

We know that the atmosphere contains none of these substances, and that it cannot restore them; we know that their abstraction from the soil entails an inequality of production, a want of fertility; and that we can, by the addition of these substances, re-establish and increase fertility.

After such numerous and striking proofs relative to the origin of the principles of animals and plants, to the utility of the alkalis, of the phosphates, and of lime, can the slightest doubt exist as to the fundamental principles of rational agriculture?

In fact, has the art of agriculture any other basis than the re-establishment of the disturbed equilibrium?

Can it be imagined that a rich and fertile country, possessing a flourishing commerce, which for ages has exported the products of its soil under the form of cattle and corn, can retain its fertility, if the same commerce do not return to it, under the form of manure, the principles removed from its fields, and which the atmosphere cannot replace? Would not such a country suffer the same fate as the lands, formerly so rich and fertile, of Virginia, where neither wheat nor tobacco can any longer be cultivated?

The large towns of England consume the products of English agriculture, and, besides, that of foreign countries. But the principles of the soil indispensable to the plant, and which are derived from an immense surface of land, are not returned to the soil. Regulations which have their source in the manners and customs of this people, and which are peculiar to this country, render it difficult, and, perhaps, impossible, to collect the immense quantity of phosphates (the most important of the mineral principles of the soil, although their proportion in it is very small,) which are daily conducted into the rivers under the forms of urine and solid excrements.

We have seen the English fields thus exhausted of phosphates present a very remarkable case; we have seen the exportation of bones (phosphate of lime) from the continent double their product, as by enchantment.

But the exportation of these bones, if it continue on the same scale, cannot fail gradually to exhaust the soil of Germany; the loss is so much the greater, as a single pound of bones contains as much phosphoric acid as a *quintal* of cereals.

The Thames, and the other rivers of Great Britain, carry away every year thousands of quintals of phosphates.

Thousands of quintals of the same substances which come from the sea, are returned into the country, in the form of guano.

The imperfect knowledge of the nature and properties of matter gave rise, in the days of alchemy, to the opinion that the metals proceeded from a seed. The crystals and their ramifications were regarded as the leaves and branches of the plant-metal, and all efforts tended to find the seed and the earth appropriate to its development. Without giving anything in appearance to an ordinary vegetable seed, it was considered to produce, by its development, a stem, and a trunk bearing flowers which produced other seeds. If the seed-metal had been possessed, similar hopes might have been entertained.

These ideas could arise only in a time when the knowledge of the atmosphere was next to nothing, when the part which the earth and air take in the vital acts of plants and animals was unknown.

The chemistry of the present day prepares the elements of water, composes this water with all its properties by aid of these elements, but it cannot create them; it can only extract them from water. The artificial water has been water before.

Many of our agriculturists resemble the

* *Annalen der Chemie und Pharmacie.*

ancient alchemists. If the latter sought for the philosopher's stone, the former seek for the wonderful seed which, without the addition of nourishment to their soil, scarcely sufficiently rich for indigenous plants, should produce a hundred-fold.

The observations made for ages, for thousands of years, cannot preserve them from the illusions always arising. The knowledge of true scientific principles alone can give the power of resisting such errors.

In the earliest age of natural philosophy, it was water alone that developed organic substances: then, it was water and certain principles of the air; now, we know with the greatest certainty that it is necessary to add other principal conditions furnished by the earth, to the latter two, in order that the plant may have the power of being reproduced and multiplied.

The quantity of aliments of plants contained in the atmosphere is limited; but it should be quite sufficient for covering the whole surface of the earth with a rich vegetation.

Let us consider, that under the tropics, and in the countries of the earth where the most general conditions of fertility—moisture, an appropriate soil, light and an elevated temperature—are united, that in these places vegetation is scarcely limited by space, that when the soil is inefficient, the plant, dying, itself with its bark and branches become a part of the soil. It is clear that the plants of these countries cannot be deficient in atmospheric aliment; neither are our cultivated plants deficient.

It is the continual motion of the atmosphere that furnishes to all plants an equal quantity of the aeriform aliments necessary to their development. The air at the tropics does not contain more than the air at the torrid zones; and yet, what a difference is shown in the power of the production of equal surfaces of land in these different countries!

All plants of the tropical regions, the wax and oils, palms and the sugar cane, contain, compared with our cultivated plants, only a small quantity of the principles of the blood, properly so called, necessary for the nourishment of the animal. The tubercles of the Chili potato, which resembles a high shrub, gathered from a whole acre of land, would scarcely suffice for one day for the sustenance of an Irish family (Darwin). The plants which serve for nourishment, and which form the object of culture, are only intermedia for the production of these principles of the blood. In the absence of the elements which the soils should furnish for their production, wood, sugar, and starch, may, perhaps, be formed in the plant, but it is not the same with the principles of the blood. If we wish to produce more of them on a given surface, than the plant in the free, natural, normal state, on this surface, can derive from the atmosphere, or receive from the soil, an artificial atmosphere must be created; the principles which are deficient must be added to the soil.

The nourishment which should be furnished to different plants, in a given time, in order to allow of free and uninterrupted development, is very unequal.

On arid sand, on a pure calcareous soil, and on naked rocks, but few kinds of vegetables grow; these are only vivaceous vegetables; only very small quantities of mineral substances are required for their slow growth, which the soil, sterile for other kinds of plants, may still furnish to them in sufficient quantity: annual plants, especially those of summer, grow and attain their complete development in a proportionally short time; they do not thrive on a soil which is poor in the mineral substances necessary to their development.

In order to arrive at a maximum of size, in the short period assigned to their life, the nourishment contained in the atmosphere is not sufficient. In order to attain the objects of culture, it is necessary to create for them, in the very soil, an artificial atmosphere of carbonic acid and ammonia. This excess of nourishment, which is wanting to the leaves, must be furnished to the organs contained in the soil, which correspond to them.

But ammonia and carbonic acid are not sufficient for producing a principle of the plant, an alimentary substance for the animal. The formation of albumen is not possible without the alkalis, nor can vegetable fibrin and caseïn be produced without phosphoric acid and earthy salts. We know that the phosphoric acid of the phosphate of lime, which is separated in great quantity under the excrementitial form in the barks of ligneous plants, is indispensable to our cereal and leguminous plants for the formation of their seeds.

What a difference between summer plants and evergreens, fatty plants, mosses, trees with acicular leaves, and the ferns. Summer and winter these latter plants assimilate every moment of the day carbon, by means of their leaves, by the absorption of carbonic acid, which the sterile soil cannot furnish to them. Their coriaceous or fleshy leaves retain the water absorbed with great force, and lose by evaporation very little of it compared with other plants.

How small, indeed, is the quantity of mineral substances which they remove from the ground in the whole course of the year, during the almost uninterrupted duration of

their growth, if we compare it with the quantity which a crop of wheat of equal weight, for example, takes from the soil in three months!

From the foregoing it results that the advantages of appropriations are based on the fact that cultivated plants remove from the soil unequal quantities of certain aliments. In a fertile soil the plants should find all the inorganic principles indispensable to their development, in sufficient quantity, and in a state which allows of their being absorbed by the plant.

A field prepared by art contains a certain amount of these principles, as well as of the vegetable substances in putrefaction and ammoniacal salts. We make succeed to a plant containing potassa (turnips and potatoes), a plant containing silica, and to the latter a plant containing lime.

All these plants require alkalis and phosphates: a plant containing potassa requires the greatest quantity of the former, and the smallest quantity of the latter. The plant containing silica requires, with the soluble silicic acid which the plant containing potassa leaves, a considerable quantity of phosphates. The plant containing lime, which follows, (peas, clover, &c.) may so exhaust the soil of this important principle, that there does not remain more of it than is sufficient for permitting the formation of the seed of a crop of oats or rye.

The number of the crops obtained depends on the quantity of alkaline silicates and phosphates, or of the calcareous and magnesian salts which are found in them.

The provision of these salts may suffice for two crops of a plant containing potassa, or lime, for three or more crops of a plant containing silica, and even for five or seven crops; but, after this time, all the mineral substances which we have taken from the soil, under the form of fruit, stems, leaves, and straw, must have been removed: the equilibrium must be re-established, in order that the land may recover its primitive fertility.

This is effected by *manure*.

It may be admitted that—in the roots and the stubble of cereal plants, in the fallen leaves of ligneous plants—the soil recovers as much carbon as it received at the commencement of vegetation, under the form of carbonic acid, produced by the destruction of humus. The stalks and leaves of potatoes, and the roots of clover, remain in the ground. These remains putrefy, and are destroyed during the winter, and the young plant and the seed find in them a natural source of carbonic acid. The soil is not exhausted of humus by these plants.

Finally, it may be concluded, from theoretical reasons, that the soil receives from plants, during their life, quite as much, or even more, of matters rich in carbon than it furnishes to them; that an act of excretion, which is operated at the surface of the fibres of the roots, enriches it with substances which putrefaction, during the winter, again converts into humus.

The existence of an act of secretion and excretion has been maintained by some physiologists, and denied by others, so that at present the opinions on this point are divided. No one doubts, however, that the oxygen which separates from the leaves and green parts, is an excrement. The vital activity of the plant assimilates in its organs the carbon of the carbonic acid, the hydrogen of the water, whilst the unassimilated oxygen is separated.

We have in flowers volatile oils, combinations rich in carbon and hydrogen, which have, likewise, ceased to belong to other vital acts. We see exude from the bark, resins, balsams, and gum; from the leaves, and from their hair sugar and mucilaginous matters.

On the surface of the barks, roots, and all parts of plants which are not green, oxygen is not separated. We observed then, on the contrary, the separation of substances rich in carbon which, produced in the vital act of the plant, have undergone no alteration. If we compare, for example, the bark of fir, of pines, of the beech, of oak, of hazel-tree, and wood, we find essential differences in their properties and composition.

Whilst wood, properly so called, leaves only $\frac{1}{2}$ to 2 per cent. of ash, the bark of the oak, the fir, the willow, and the beach, gives 6·10, and even 15, per cent., the ash of the wood and that of the bark have a very different composition. The inorganic principles of the bark are evidently substances which the living organism has rejected. A similar origin should be admitted for the organic principles of the bark. That of cork contains nearly half its weight of fatty substances or analogous matters, which we find, but in smaller proportion, in the barks of the fir and pine. The solid principle, of these barks, insoluble in alcohol or ether, is perfectly different from the substance of wood. The barks of fir and oak almost completely dissolve in a solution of potassa, forming a liquor of a deep brown color, from which the acids precipitate a matter which has the greatest resemblance to the substance called ulmic-acid. Wood is not attacked by a solution of potassa.

These barks are true excrementitial substances, since they arise from the living plant, and no longer take any part in its vital functions. They may be removed from the plant without putting its existence in danger. It is known that most of the plan-

tains are annually deprived of their bark. Taking, therefore, this fact in its true signification, it is evident that there are formed in this ligneous plant, by aid of certain combinations produced in its vital act, substances which, not having to undergo any further change, are eliminated.

We have every reason to believe that this elimination takes place all over the surface: we observe it not only on the trunk, but also on the smaller branches; and we should conclude that this act of excretion is operated also in the roots.

We see that rain-water, in which a branch of willow vegetates, is gradually colored of a deep brown. We observe the same phenomenon with bulbous plants (hyacinths), which are grown in pure water. It cannot therefore be denied that there is an elimination of excrementitial substances in plants, although it may not take place to the same extent in all.

The enriching of the soil with organic substances by the culture of vivaccous plants, such as the *espacette* and the clover, which are distinguished by the abundant ramifications of their roots, as well as by the great development of their leaves, is considered as a positive fact by most agricultural writers, and which is perhaps explained in the preceding.

We cannot operate the formation of ammonia on cultivated lands, but indeed an artificial production of humus. It is the latter which should be considered as one of the objects of appropriations, and as a second cause of their advantages.

It is by sowing a field with clover, rye, lupins, sarrasin, &c., and by incorporating in the ground plants ready to flower, by tillage, which we create in consequence of an act of destruction of the new-sown seed and of the young plant which is developed, a maximum of nourishment, an atmosphere of carbonic acid: all the nitrogen which the first plant took from the air—all the alkalis and phosphates which it received from the soil, serve to render more beautiful and more luxuriant the vegetation of the plant which follows.

ANALYSIS OF A SAMPLE OF GUANO FROM THE ISLAND OF ICHABOE, AFRICA.

BY JOHN AND CHARLES WATT.

The following is an analysis of a sample of guano from the Island of Ichaboe, received from Mr. James C. Kemp, of Liverpool, and which is superior to most samples from other parts of Africa which we have analysed:—

Ammonia, partly in the state of carbonate	10·0
Bone phosphate of lime, including a portion of oxalate of lime	24·0
Uric or Lithic acid	4·0
Alkaline salts, consisting principally of chloride of sodium	3·5
Phosphoric acid	4·0
Moisture, including a small portion of organic matter, volatile at 212° F	24·0
Traces of silica, iron, &c.	0·5
Other organic matter, &c.	30·0
	100·0

The chief portion of the ammonia is in combination with the phosphoric and uric acids, and the remainder with carbonic acid.

Royal Polytechnic Institution,
March 9, 1844.

PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

ADULTERATION OF LAC SULPHURIS.

BY LEWIS THOMPSON, M.R.C.S.

"Pudet hæc opprobria
—— non potuisse refelli."

To the Editors of The Chemist.

Gentlemen—

Having been lately engaged in the examination of some drugs in the shop of a friend in Davies-street, Berkeley-square, my attention was arrested by an article marked Lac Sulphuris, which differed, however, in many respects from genuine milk of sulphur. This preparation had a light cream color, was infusible at a temperature of 300°F. and only partially volatilized by a red heat. When a small piece of it was held in the flame of a candle, it burnt without any appearance of fusion, and left a bulky white ash behind. On analysis it yielded:—

Sulphur	42
Water	12
Sulphate of lime	46
	100

As this result rendered it doubtful under what denomination the article should be vended, whether as sulphur, water, or plaster of Paris, my friend, who had opened his shop with the laudable determination of

selling none other than genuine drugs, desired me to write to the parties from whom the article had been obtained, stating his unwillingness to sell such a compound for internal use. In due time an answer arrived, which was as follows:—"The lac sulphuris sent is the usual article that is sold; it is understood not to be a *pure* article; the price of *pure* is 1s. 6d. It is *very rare indeed* that any of the latter is sold—shall we send you any of it?" Now, Gentlemen, what are we to infer from the term "understood?" Do people "understand," that in taking an ounce of milk of sulphur, they swallow half an ounce of plaster of Paris? Do physicians "understand," that in ordering precipitated sulphur, their patients will take sulphate of lime? Or does the anxious mother, in administering milk of sulphur to her children, understand that she is dosing them with gypsum? That sulphate of lime may make good plaster, and prove beneficial as a manure, are unquestionable facts; but that large doses taken into the stomach do not produce most prejudicial effects, is a circumstance which ought to have been proved ere this substance was selected for so wholesale a mode of adulteration. That it is not inert, I am certain; for a mixture of recently burnt gypsum with twice its bulk of oatmeal, is a provincial and an effectual means of poisoning rats. But what cares the drug merchant? Poisonous or not, the thing is "understood!" Indeed, the cool, deliberate, uncompromising character of the letter is not a little remarkable, and speaks volumes. There is no attempt to gloss over the affair; no mistake of the shopman, no inquiry, no investigation to be instituted, no sample demanded, no future extra attention promised, no excuse that, not being the makers, they were ignorant of the fact. No, no! nothing of the kind—they knew it well; it was "understood" not to be pure; moreover, it is very rare indeed that any of the pure is sold. "He that hath ears to hear, let him hear:"—the universality of the crime has become its apology. Here, then, stands the fact, the pure, unadulterated quintessence of brazen imposition, the inspissated extract of reckless fraud. One of the largest and most influential firms in the drug trade, possessing almost unlimited information on this important subject, tells us that pure milk of sulphur is very rarely sold; that this medicine, which, next to Epsom salts and castor oil, is the most popular panacea for many of the ills that flesh and skin are heirs to, is contaminated with 50 per cent. of plaster of Paris, and in this state crammed down the throat of the too confiding public! And such, indeed, is the fact; for, in six samples obtained from sixty different shops, I have found so little variation as might excuse the supposition that sulphur and sulphate of lime combined together in some atomic proportion constituting a kind of *emplastrum sulphuris*, to which some ingenious individual had applied the term milk of sulphur, as an addition to the equally innoxious tea-table association of sugar of lead and butter of antimony. That I have not published the names of the individuals concerned in this matter, is from no motives of fear, but simply because, bad as they are, they are quite as good as their neighbors, and it would be unfair to make an example in the first instance, when 99 per cent. of the trade are in the same position. Let this, however, be a warning; the next offender shall hang for ever on your pages.

In justice to an oft abused batch of monopolists, I must add that all the drugs and chemicals which at various times I have obtained from the Apothecaries' Hall, have been of the very best description, and that the lac sulphuris of that establishment is pure, except in containing about 500th of its weight of sulphuret of iron, the metal of which is no doubt derived from the muriatic acid employed in the process, and in no way affects the medicinal value of the article.

I have also on several occasions, at the request of others, examined drugs obtained from Mr. Morson, near Bloomsbury-square, and have invariably found them pure, and quite equal to those sold by the Apothecaries' Company.

Such, then, is the extent of my knowledge in regard to the places where pure medicines may be procured. In a short time I hope to make the exceptions to purity as rare as I now find them in regard to adulteration. Meantime, those about to take sulphur will do well to observe, that a portion of it heated to redness in a tinned-iron or earthenware spoon, should leave little or nothing behind; if otherwise, it is unfit for use.

I am, Gentlemen,
Very truly yours,
LEWIS THOMPSON.

LIQUOR OPII SEDATIVUS.

BY A. J. COOLEY.

IT is a matter of considerable inconvenience to the medical practitioner, and often of serious injury to both himself and patients, that such a variety of liquid preparations of opium should be sold under the above name. Many of these, which have come under my notice, in the last few years, have varied so sensibly in quality and even in appearance, as to lead

me to a further examination of the matter. In some cases the article resembled a *weak tincture* of opium; in others a *vinum opii;* but more generally an *acetum opii*, to which, in almost every case, spirit had been added. Some samples were very improperly named *sedative*, possessing equally narcotic properties with the common tincture of the shops.

This difference in quality and composition will scarcely appear singular, when we consider the variety of opinions which appear to exist relative to the original preparation. The general belief appears to be (with only two or three exceptions, and those of a very recent date), that the L. O. S. of Battley* is a solution of "*impure* acetate of morphia," or in other words, an acetum opii.

In illustration I will quote Dr. Paris, who says, in his Pharmacologia, page 621—

"Under this name, Mr. Battley, a manufacturing druggist, of Fore-street, London, has offered for sale a narcotic preparation, which is generally supposed to owe its efficacy to the acetate of morphia."

Dr. Thomson, in his New Dispensatory, (10th edition, 1844,) remarks—

"There is some reason for thinking that another preparation of opium, the Liquor Opii Sedativus of Mr. Battley, of Fore-street, London, which has justly been esteemed an excellent preparation of the drug, owes some of its efficacy to the acetate of morphia, if it be not a simple, impure solution of the bimeconiate."

Other quotations of a similar nature might easily be made, but these may be well superseded by reference to the various formulæ, which have from time to time been recommended to produce either substitutes or imitations of this "excellent preparation."

Going back then to Dr. Paris, I may mention the formula of Messrs. Macqueen and Baker, to which 20 lines of close print are consigned in the Pharmacologia, and which concludes with the following strong language:—

"The profession ought to feel deeply indebted to these manufacturing chemists, who, quitting the usual routine, take pains to observe and to reason on what they observe."

The process is—

Triturate Turkey opium with several portions of cold distilled vinegar, filter, evaporate to an extract, dissolve again in distilled vinegar, filter, and again evaporate. Dissolve in proof spirit, set aside for one week, then filter.

Haden, in his Translation of Magendie's Formulary, recommends the "dregs left from making tincture of opium, to be macerated in a dilute solution of tartaric acid."

Mr. Horne's formula is:—

"Three times the quantity of the best opium that is ordered in the pharmacopœia for two pints of tincture to be reduced to fine powder, and added to two pints of dilute acetic acid. After they have been digested for a few hours, add six or eight pints of rectified spirit of wine, macerate for seven days, filter, introduce the liquor into a retort, and draw off the spirit. The liquor in the retort is the Acetum Opii Sedativus."

In a publication contemporaneous with The Chemist, several pages were lately devoted to the subject, and the following formula proposed:—

℞. Acetous extract of opium, 1½ ounces, or hard opium, in powder, 3 ounces, distilled water, 1½ pints, rectified spirit, 10 fluid ounces; dissolve and filter.

Messrs. Smith, of Edinburgh, (Chemist, vol. ii., page 284) propose a method of forming a solution of opium, of purely sedative properties, so far as absence of narcotine goes, but as it has been justly remarked, that, like their plan for making iodide of potassium, lately published in the *Pharmaceutical Journal*, it is much too tedious and complicated for any useful purpose Other authorities might be adduced, who recommend formulæ for the production of sedative solutions of opium, intended either as imitations, or substitutes for Battley's L. O. S., but I will content myself with two, whose views coincide with my own.

Dr. Pereira (*Therapeutics and Materia Medica*, 2nd edition, p. 1772) says,—

"Mr. Battley, some years since, assured me that the only ingredients used in the preparation of his Liquor Opii Sedativus, were *opium, water and heat.* It appears to contain less meconic acid than the ordinary tincture of opium. Probably this and some of the principles of opium, are got rid of by successive evaporations and solutions. Perhaps an aqueous solution of the watery extract of opium, with the addition of a little spirit to preserve it, would be a convenient substitute."

In page 90 of a useful little work, "The Pocket Formulary," similar language is employed. The general opinion is, however, as I have previously stated. In several conversations I have had with members of the medical profession, I find this to be par-

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* I wish it to be distinctly understood that Battley's Liquor Opii Sedativus is the article alluded to throughout this paper; *other preparations*, though possessing similar properties and called by the same name, not being (knowingly) admitted as such by the medical profession, or allowed to be substituted for it in dispensing.

ticularly the case. In one instance I asked, "But WHY, sir, do you suppose Battley's L. O. S. to be an impure acetate of morphia?" To which the gentleman very testily replied—"*Suppose!* sir; why, there is *no supposition* in the case! Men of eminence in the profession, who know much more about these matters than either of *us*, are satisfied on the subject." And, in fact, my friend appeared *perfectly satisfied*, although I must be candid enough to say that his feelings were not participated in by myself. I recommend those who entertain the above opinion, to examine for themselves. Let them sacrifice a small quantity of the article in actual experiments, and thus settle the account with their consciences, ere they offer any preparation of their own manufacture for sale or exhibition. This is the more necessary, from at least four-fifths of the L. O. S. now sold being manufactured by other wholesale druggists than Mr. Battley. In fact, every house has its particular formula, which is esteemed a most important secret. The reason of the latter can only be, that they doubt its *correctness* and *honesty*. This will continue to be the case, so long as Mr. Battley chooses to charge the *foolishly high price* of between twenty and thirty shillings a pound for his nostrum. Did Mr. B. charge a *reasonably remunerating price* only, the inducements offered from cheapness to buy away from him would immediately cease, and consequently the spurious manufacture.

The examination for acetic acid is easily conducted, by parties even but slightly acquainted with chemical manipulation. If acetic acid be absent, then must the preparation be—neither a solution of impure acetate of morphia, nor an acetum opii. From my own experiments, (made on a sample procured at Mr. Battley's warehouse,) I have satisfied myself of the following particulars: –

That it contains less meconic acid, resin, and extractive matter, than opium; that it contains scarcely a trace of narcotine, and no fatty matter or caoutchouc; that it contains but a small portion of spirit; that the peculiar smell it possesses is that imparted to an infusion of opium in water by the action of heat; and lastly, that it is a solution of impure meconate of morphia, combined with such other vegetable extractive matter as is soluble in temperate distilled water; the peculiar differences in color, taste, &c., being such as are produced by the after application of heat. These results coincide with the opinions of Dr. Pereira just quoted, and, with some little alterations, his suggestions may be followed.

Either of the following formulæ will produce—not an imitation or substitute, but—the *Liquor Opii Sedativus* itself.

I.

Take dry opium (Smyrna) in powder 1 part
Clean washed (silica) sand.... 2 ,,
Mix, and moisten with water; put the mass into a suitable percolator, and pass distilled water at 65° or 70° Fahrenheit, through the ingredients, until it passes both tasteless and colorless. Evaporate the liquor (by steam or water bath) to the consistence of a *hard pill extract*. Then take of this

Hard extract	3 oz.
Distilled water.....	30 ,,

Boil for two minutes; let it cool; filter; then add

Rectified spirit.....	6 oz.
Distilled water.....	q. s.

to make up 40 fluid ounces, or exactly one quart.

To those who are inexpert in using the percolater, the following plan will prove more convenient:—

II.

Take Turkey opium (Smyrna).. 6 ounces; tear it into small pieces, and macerate in ½ a gallon or less of distilled water, at 65°, for twelve hours; strain with expression, and repeat the process until the opium is exhausted; filter the mixed liquors, evaporate as before to about thirty ounces; let it stand until the next day, filter, and add

Rectified spirit	6 ounces
Distilled water	q. s.

to make up one quart measure (exact).

III.

Take ext. opii (P.L.)	4 ounces
Distilled water	40 do.

Boil till reduced to 34 ounces; then add

Rectified spirit	6 ounces.

Let the product be exactly 40 ounces.

N.B.—This article should not be filtered until *quite* cold, and this had better be done in a *cold* place, as, if otherwise, it is apt to lose its brightness on a change of temperature. One or two cloves (at the most) per pint, added to the store bottle, will make it *keep well*, without the least symptom of change. Should the situation be very warm, an ounce or two more spirit may be added after the last filtration, using less water. The above quantity of cloves is quite insufficient to impart a *flavor*. I frequently make it myself, without any spirit whatever, for immediate use.

ON VACCINATION, AND ON THE REPRODUCTION OF VACCINE MATTER DIRECT FROM THE COW.

BY MR. J. BADCOCK, CHEMIST, BRIGHTON.*

Of all the diseases in the vast and melancholy catalogue of ills which flesh is heir to, few are more virulent or of more fatal effect than the small-pox. It is, therefore, a solemn duty, incumbent on all connected with medical practice, to listen, with no ordinary attention, to any and every suggestion calculated, in however small a degree, to diminish the ravages of so terrible a scourge; and happy indeed shall I be, if my humble endeavors shall be deemed to have effected ever so little for our knowledge concerning what appears to be the only means of protection against its violence. We have to be thankful that that Almighty and Infinite Being, who has afflicted on mankind so awful a manifestation of His power, has also, in these latter days, through the illustrious and thereby immortalised Jenner, communicated to us the means of combating a disease, which for centuries had pursued its terrible course unimpeded. Yes, indeed, vaccination can be regarded only as the direct gift of Heaven; but, like all other divine gifts, it has been rendered by scepticism less availing than it might have been. It it our duty, on all fitting occasions, to diffuse the blessings of vaccination to the utmost of our ability, and to neglect nothing calculated to improve its efficiency.

It was with a strong impression of this obligation, and with a sincere desire to promote the welfare of society, by contributing to the best of my humble ability to our knowledge of the subject, that I undertook those investigations which, in the course of this paper, I shall have the honor of laying before you; and I am induced to make them known to you, in the earnest hope that they will attract the attention of those who are possessed of greater ability to render them useful to mankind.

I may avail myself of the present opportunity of returning my sincere thanks to those talented medical gentlemen who, with that ardor in the pursuit of interesting scientific investigation which characterises their profession, have so kindly afforded me that assistance in my investigations, without which, they would have been far less worthy of your attention.

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* Read before the Brighton Literary and Scientific Institution: communicated to THE CHEMIST by the Author.

It is my intention, in this paper, first to advert to the state of our knowledge with regard to small-pox, previous to the introduction of the practice of vaccination, and then to proceed to the detail of my own experiments.

Some estimate of the immense debt of gratitude which we owe to that benefactor of the human race, Dr. Jenner, for that discovery which has immortalised his name—the discovery of the protective influence of vaccination against small-pox—may be formed by referring to the melancholy accounts furnished to us of the terrible ravages, before *his* time, of that dreadful disorder; for it is stated, that in London and its immediate vicinity, *three thousand lives* were *annually* sacrificed to it.

To mitigate, in some degree, the severity of small-pox, the practice of inoculation was introduced into England, about the year 1717, by Lady Montagu. In a letter from Adrianople to a friend in this country she says,—"I am going to tell you a thing that will make you wish yourselves here. The small-pox, so general and so fatal amongst us, is here entirely harmless by the invention of ingrafting, which is the term they give it. There is a set of old women who make it their business to perform the operation every autumn, in the month of September, when the great heat is abated. People send to one another to know if any of their families has a mind to have the small-pox. They make parties for this purpose, and when they are met (commonly 15 or 16 together) the old woman comes with a nut-shell full of the matter of the best sort of small-pox, and asks what vein you please to have opened. She immediately rips open that you offer to her, with a large needle (which gives no more pain than a common scratch), and puts into the vein as much matter as can lie on the head of her needle, and after that, binds up the little wound with a hollow bit of shell: and in this manner opens four or five veins. The Grecians have commonly the superstition of opening one in the middle of the forehead, one in each arm, and one on the breast, to mark the sign of the cross, but this has a very ill effect, all these wounds leaving little scars, and is not done by those who are not superstitious, who choose to have them in the legs, or that of the arm that is concealed. The children or young patients play together all the rest of the day, and are in perfect health to the eighth. Then the fever begins to seize them, and they keep their beds two days, very seldom three. They have very rarely above 20 or 30 in their faces, which never mark; and in eight days' time they are as well as before their illness.

Where they are wounded, there remain running sores during the distemper, which I don't doubt is a great relief to it. Every year thousands undergo this operation; and the French Ambassador says pleasantly, that they take the small-pox here by way of diversion, as they take the waters in other countries. There is no example of any one that has died in it, and you may believe I am well satisfied of the safety of the experiment, since I intend to try it on my dear little son. I am patriot enough to take pains to bring this useful invention into fashion in England; and I should not fail to write to some of our doctors very particularly about it, if I knew any one of them that I thought had virtue enough to destroy such a considerable branch of their revenue for the good of mankind. But that distemper is too beneficial to them not to expose to all their resentment the hardy wight that should undertake to put an end to it. Perhaps, if I live to return, I may, however, have courage to war with them."

Indeed, she recommended it by her own example;—the first person inoculated with small-pox in England was her own daughter.

Though the mildness of the disease communicated by inoculation, compared with that caught in the natural way, was such as to reduce the number of *fatal* cases from one to six, to one to three hundred, still was the degree of risk sufficient to alarm the anxious parent, when the life of a beloved child was at stake; nor was inoculation always able to prevent those unsightly scars and deformities, and the subsequent injury to general health, which are so frequently the lamentable results of a severe form of this *truly malignant* disorder. But the positive evil arising from the partial adoption of inoculation for the small-pox was a more extensive propagation of the disease in the natural way, and a single individual, interested in the welfare of *one child*, may have occasioned the death of thousands.

Such was the condition of medical science relative to this disease, when the comprehensive mind of Dr. Jenner discovered the *protective* influence of *vaccine*. His investigations concerning the nature of vaccine, or *cow-pox*, commenced about the year 1776. His attention to this singular disease was first excited by his having observed that, among those whom he inoculated for the small-pox, many were susceptible of that malady. He was informed that these persons had *had* the casual cow-pox, a disease which had been known in the dairies from time immemorial, and concerning which a vague opinion, that it had the property of preventing the small-pox, had long prevailed.

During the investigation of the casual cow-pox, he became impressed with the idea that this disease might be propagated by inoculation, first from the cow to the man, and then from one human subject to another.

The first experiment which he made was in the spring of the year 1796, on a lad named Phipps, with virus taken from the hand of a young woman who had accidentally caught the disorder from a cow. As the indisposition which attended this inoculation was so exceedingly slight as to be barely perceptible, he scarcely felt certain of having secured the boy against small-pox; but, on his being inoculated several months subsequently, he proved to be completely protected; he was inoculated with active *small-pox* matter, for the fourth time, in the month of May, 1805, also without any effect. Dr. H. Jenner, now residing at Berkeley, informed me in a letter which I received from him about eighteen months since, that Phipps was then alive and well, and following the employment of a gardener in his family.

The practice of vaccination, introduced by Dr. Jenner nearly fifty years ago, is now carried on in all parts of the world, with the most happy effect; shielding millions of lives against the *dire pestilence* of small-pox, and, under proper and judicious management, leaving in the system nothing prejudicial to health. In admitting the blessing conferred on suffering humanity by Jenner's invaluable discovery, it may not be amiss to inquire whether we avail ourselves, to the fullest extent, of the advantage which it holds out to us. In my humble opinion, we do not.

I think that we have not attached sufficient importance to the practice of vaccination, nor carried out the discoverer's views in that respect; and, perhaps, we may, in some measure, attribute to this cause the increase of small-pox within the last few years.

I have very good authority for stating that, during infancy, the progress of vaccination is frequently very much interfered with by dentition and infantile disorders; and, from this cause alone, is not uncommonly imperfect. Dr. Heine, in his treatise on small-pox and vaccination in Wurtemberg, gives the results of many cases tending to prove that cow-pox is not so well developed in early infancy; that, indeed, immunity from cow-pox infection may then, to a certain extent, exist, and that, therefore, too early a vaccination of children cannot be regarded as proper *in all cases*, and especially within the *first year*. But, in the situation in which most of us are placed,

having to bring up our families in thickly-populated towns, where the small-pox is almost always present, it is quite necessary to have our children vaccinated at a very tender age, or they would be exposed to very considerable risk.

In such cases, I consider it our duty to avail ourselves of the valuable test of *re-vaccination*, when they grow older, and I have adopted that precaution in my own family.

I will now lay before you the opinions of some men of the highest professional reputation, in support of re-vaccination, beginning with that of Mr. Erasmus Wilson, as given in a lecture delivered, last summer, at the Middlesex Hospital. Under the head of extension of vaccine protection, he thus commences :—

"Whether vaccination, when properly and efficiently performed, be capable of prolonging its influence indefinitely, is a question of much importance, but one which cannot at present be answered. Were it, indeed, effectual, our sole anxiety would be to secure the perfection of vaccination; but, in a state of doubt, it becomes doubly necessary to be vigilant in our performance of the operation, and to take such steps as may best anticipate any probability of failure.

"We have seen that the causes of interference in relation to vaccination are very numerous; that the subject vaccinated may be too young; that he may be in a state of health unfavorable to the success of the operation; or that the lymph may be incompetent, either as being obtained too late, or from an imperfect vesicle. With all these chances of failure before us, we shall not be surprised to find that an impression, unfavorable to the powers of vaccination, exists in the minds of practitioners. For the purpose of meeting this difficulty, re-vaccination has been suggested, and on the continent extensively practised. Re-vaccination promises to us more than one advantage: it is a simple and harmless operation in itself, and, if the vaccinated person be susceptible of its influence, it may be regarded as determining—firstly, the unprotected state of the individual; and; secondly, his future protection.* *An infection, of whatever nature, introduced into the animal system, induces such a modification in that system, as to render it insusceptible of the future influence of that infection.* But a question difficult of solution, is—For what length of time is the system protected? The physiological changes that are known to be constantly taking place in the system, together with observation, would lead us to infer that the period of existence of the influence is variable—at one time, and more rarely, extending over the whole of life, but more frequently restricted to a limited period. The admission of a possibility of the decline of the vaccine influence leads us at once to the necessity of re-vaccination, and leaves us no other question to determine than the periods at which the operation should be performed. I should advise that vaccination be repeated every seven, or every ten years. If the system receive not the inoculated virus, it may be regarded as protected, and no inconvenience results to the subject of operation; while, on the other hand, if the operation be successful, the inconvenience will be temporary and trifling, but the advantages great." Such were also Dr. Jenner's views: he considered that if the constitution show an insusceptibility of the vaccine influence, it commonly stands in the same relation to the small-pox; and he recommended this test, whenever any doubt existed.

At a meeting of the Royal Chirurgical Society, in February, 1841, Sir Benjamin Brodie in the chair, a very elaborate and valuable paper on Small-pox was read, from the pen of Dr. Gregory, physician to the Small-pox Hospital.

From that paper it appeared that during the previous month (January) a greater number of patients had been admitted into that *excellent* institution than in any month since its establishment—*a period of more than* one hundred *years*, the first sixty of which were *previous* to Jenner's discovery of the protective influence of vaccination!

"With regard to the protective influence of vaccination, an extensive series of statistical facts had proved that of every hundred persons who had been seized with small-pox subsequent to vaccination, only seven died; whilst, of the unprotected, forty-five in a hundred fell victims to this dreadful disease. * * It likewise appeared, from the very animated discussion that followed, that re-vaccination ought to be performed as a fresh protection in ALL cases; but more especially when any doubt existed concerning the *complete* success of the previous operation. The period of life at which the re-vaccination is performed was regarded as most important. The most proper period for the vaccination of an infant was considered to be about the *fourth month*, at which time the subject is free from dentition and other contending influences in the system, and before which time the child has not arrived at that degree of plumpness which is requisite for the introduction of the lymph."

* By the acknowledged laws of medical science, then, vaccine which is derived from small-pox offers a better chance of protection than that derived from grease, which has no connection with the infection of small-pox.

This was considered to explain the causes of failure of the operation, on more than one occasion, in the case of the *Princess Royal*, who, singularly enough, was born during a small-pox epidemic.

The subject of vaccination became one of interest to me, from circumstances which I am about to mention.

Towards the end of the year 1836 I suffered severely from a dangerous attack of small-pox, and my mind having previously been impressed with an idea that the *old vaccine* had lost its protective influence by passing through so many constitutions, during the long period of forty years, I was exceedingly anxious to procure some fresh from the cow, for the purpose of having my own children re-vaccinated. On inquiry, I found that the true disease so seldom prevails among cattle, that but few medical men have any acquaintance with it; and I also learned, from very excellent authority, that disastrous consequences have arisen from inexperienced persons communicating other pustular diseases of the animal in mistake. The only satisfactory mode of obtaining, with certainty, the *true* vaccine that presented itself to my mind was, therefore, to inoculate a healthy cow with small-pox matter, as the result of that operation, if any, must be cow-small-pox. I must here mention that this method of obtaining vaccine is opposed to Dr. Jenner's theory; for he informs us that the origin of vaccine was a disease on the heel of the horse, called the *grease*, and communicated to the cow by the milkers. But, perhaps, it will be best to quote his own words:—"The *grease*," says Dr. Jenner, in a work published in 1798, "is an inflammation and swelling in the heel, from which issues matter possessing properties of a very peculiar kind, which seems capable of generating a disease in the human body (after it had undergone the modification which I shall presently speak of) which bears so strong a resemblance to small-pox, that I think it highly probable it may be the source of that disease. In this dairy county (Gloucestershire, and the surrounding counties,) a great number of cows are kept, and the office of milking is performed indiscriminately by men and maid-servants. One of the former having been appointed to apply dressings to the heels of a horse affected with the *grease*, and not paying sufficient attention to cleanliness, incautiously bears his part in milking the cows with some particles of the infectious matter adhering to his fingers. When this is the case, it commonly happens that a disease is communicated to the cows, and from the cows to the dairy-maids, which spreads through the farm until most of the cattle and domestic cattle feel its unpleasant consequences. This disease has obtained the name of cow-pox. With respect to the opinion adduced, that the source of the infection is a peculiar morbid matter arising from the horse, although I have not been able to prove it from actual experiments conducted immediately under my own eye, yet the evidence I have adduced appears sufficient to establish it."

But this doctrine of Jenner's does not appear to be well supported. It is well known that the lower animals have a variolous disease, resembling our small-pox, and it is more than probable that the cows were laboring under that disorder or human small-pox. In searching for information on this subject, I found the following in an old work written by Dr. Fuller:—"Mr. Mather, in his letter from Boston, in New England, saith that Dr. Leigh, in his Natural History of Lancashire, reporteth that there were some cats known to catch the small-pox, and pass regularly through the state of it; and at last he telleth us, we have had among us the very same occurrence. For, in like instance, there was, about the year 1710 or 1711, upon the South Downs in Sussex, a certain fever raging epidemically among the sheep, which the shepherds called the small-pox; and truly in most things it nearly resembled it. It began with a burning heat, and unquenchable thirst; it broke out in fiery pustules all the body over. These matured, and, if death happened not first, dried up into scabs about the 12th day. It could not be cured, no nor in the least mitigated, by phlebotomy, drinks, or any medicines or methods they could invent or hear of. It was exceedingly contagious and mortal, for, where it came, it swept away almost whole flocks; but yet it could be in nowise accounted the same as our human small pox, because it never infected mankind."

Having, as I have already stated, lost some of my confidence in the old vaccine, and being desirous of avoiding the risk of taking the casual disease from the animal, I solicited some of my medical friends to inoculate a cow of mine with small-pox, but their want of leisure from professional duties disappointed me in that respect, and, after waiting nearly three years, I undertook the experiment myself.

On the 13th of December, 1841, I commenced operations on a fine young cow, with small-pox matter taken from a strong, healthy girl, and was singularly successful. My own little boy was the first vaccinated from the cow, and from him and successive vaccinations, I have carefully kept up the supply of vaccine. In these proceedings, the utmost caution was observed for the public safety, as well as to make the experiment interesting

to the profession. Three days after inoculation with small-pox, the cow was inspected by medical men, the vesicle was watched in its progress, and the lymph taken in their presence. I also placed all my early cases of vaccination under the inspection of medical practitioners, and a great number of them visited my little boy during the progress of the disease. After my success in this experiment, my next was to inoculate a pony with small-pox, but without any result. I was equally unsuccessful with three cows which I inoculated with grease (the reputed source of Dr. Jenner's vaccine), for in all I failed to produce anything like a vaccine vesicle. It was not until some time after the commencement of my investigations, nor, in fact, before I had succeeded in my object, that I became acquainted with the experiments of Mr. Ceely, of Aylesbury, made in the year 1839, and so beautifully illustrated in the eighth volume of the Transactions of the Provincial, Medical, and Surgical Association.

Mr. Ceely, in his paper inserted in the volume of the Transactions, to which I have just alluded, has treated the subject most scientifically, and, by his experiments, has clearly established the identity of cow-pox with small-pox. In correspondence with him, I was astonished to find that an anecdote which he had heard of a relative of mine, the late Mr. Allsop, surgeon, of Watlington, had led him to investigate the subject.

In conclusion, I may again refer to a portion of Mr. Erasmus Wilson's Lecture, showing his opinion of the identity between the two diseases :—"We may," says this clever surgeon, "regard *vaccine* in another and its true light, namely, as identical with variola, and consequently the operation as the same with inoculation with small-pox ; the only difference being the greater mildness of *vaccine*, resulting from its transmission through the cow. In this sense it is clear that variolation, after vaccination, is re-vaccination in all excepting in name."

Among the chief advantages to be derived from my method of obtaining vaccine lymph, may be reckoned the avoiding of the filthy association of the grease of the horse, and the power of producing fresh vaccine at pleasure, thus satisfying the prejudices of those who are fearful of the deterioration or contamination of the old vaccine. This speedy conversion of a direful poison into a benign lymph cannot be too highly appreciated when viewed in reference to distant parts of the globe, where, on the breaking out of small-pox, the old stock of vaccine matter is not to be procured.

It has been my desire to give a brief history of the origin of inoculation with the small-pox, and by comparison, to set forth the superlative advantages of the latter ; and it has also been my object, in doing so, to show how all prejudices against vaccine may be removed, by establishing the identity of the true disease.

There still remain advocates of the practice of inoculation with small-pox virus, and likewise some who object to the old *vaccine* virus, from the impression that it is impure, and liable to introduce other diseases into the system : again, there are others who entertain the opinion that its protective power has become modified by its transmission through so many constitutions. This latter suspicion led me to attempt the experiment of producing a fresh stock.

In conclusion, I repeat my acknowledgments to my professional friends for the assistance they have so kindly rendered me in putting my new vaccine to the test, and for so freely *giving* me their testimony of its efficiency ; and I thank you for the indulgence with which you have heard my remarks on a subject which I have endeavored, I know not how successfully, to invest with as much interest as possible.

Mr. Badcock having concluded, Mr. Seymour observed that the Institution must, with himself, feel much indebted to Mr. Badcock for his very important and scientific paper, which contained facts for its basis, the results of comprehensive and interesting experiments, and introduced to this Society with an inductive reasoning which was highly satisfactory, logical, and convincing. Further, he held in his hand a book which contained correspondence from a large number of the first medical men from all parts of the kingdom, approving the experiments, and testifying to their value; and though time would not allow him to enter into that series of correspondence, he would just mention one circumstance of our distinguished townsman and eminent physician, Sir M. Tierney, who had so strongly felt the value of pure vaccine virus that he requested Mr. Badcock to vaccinate a young lady, who was his particular friend, with this new matter; and, indeed, no improvement had been made from the time of Jenner until the discoveries of Mr. Badcock and Mr. Ceely, whom Mr. B. had alluded to this evening. Their experiments set the matter at rest ; it was now a science, that they could produce pure lymph at will. They need no longer use the grease from the horses' heels. He was surprised, from the great importance of the question, there were not more medical men present to take part in the discussion. Why should they withhold the benefit of their opinions, for a more valuable paper had never been submitted to that Society?

TO THE COUNTRY CHEMISTS, MEMBERS OF THE PHARMACEUTICAL SOCIETY.

GENTLEMEN—

THE time for payment of our third or our fourth subscription, of two guineas to the Pharmaceutical Society, has gone by, and now we may begin to look around us and ask what the *bonâ fide* benefit we have received really amounts to? We have obtained our charter, and we have our diploma. Will any one say that six, or by some eight guineas each, is not a sufficient sum to pay for these boons? The Council will ask also, "Have you not had our Journal? have you not had the effusions of the wisest of our body—an account of our transactions in Bloomsbury-square? In fact, what we give you in our Journal is worth your two guineas!!" This, Gentlemen, is all fudge—we have a better Journal by half in THE CHEMIST, for twelve shillings per annum.

Many of us are young men, married, and with families coming on, and in the course of nature it may be probable that, with God's blessing, we may live for 30 or more years to come; this two guineas a-year would provide our families with £100 at any of the Insurance offices, let our death take place when it will; or, if our taste so incline, we may have a very handsome library in 30 years by laying out judiciously two guineas a-year.

Gentlemen, it is all very well for the London chemists; it is worth to them two guineas a-year—they have the Museum and the Library for their use, the meetings to attend, with many other privileges of which we have not a shadow.

Gentlemen, Mr. Jacob Bell has given us some very lucid definitions of competition in trade, which we all knew as well as this learned journalist, and many of you better; but is there one successful endeavor to ameliorate the condition of the poor country chemist, who is working through severe privation against the tallow chandler, the grocer, the oilman, &c.? There has not been one attempt made; much talk has been talked—most soothing expressions, bland, mild, and good-tempered. Poor fellows! poor fellows! your case is hard, but only give us your two guineas, and all will be well!!

In short, Gentlemen, the benefit we in the country receive from this Society is not equivalent to the sum we pay, or at least it is unequal to that of our metropolitan brethren; for if our standard be two guineas, let the Londoners pay three or four; and if a revenue is to be got up, let it be properly placed on the right quarters, in equal and well-balanced proportions. Gentlemen, let us not stand and see this Institution, which should do us all good, carried on in this do-nothing sort of way;—some of you come forward, and wield the engine of our rights, which many of you are well able to do, and you will receive the thanks of us all.

I am, Gentlemen,
Your obedient servant,
A FELLOW COUNTRY MEMBER OF THE PHARMACEUTICAL SOCIETY.

THE PROFOUND CHEMICAL SAGACITY OF THE EDITOR AND HIS "SUB" OF THE "PHARMACEUTICAL JOURNAL."

GENTLEMEN—

IN the February Number of the *Pharmaceutical Journal* there appeared an article on the Preparation of Precipitated Chalk or Carbonate of Lime, which the editors had, through the *grossest ignorance* or *negligence*, inserted; wherein it stated that impure animal charcoal, or bone ashes, was a good and economical *source* of that substance. It was proposed to digest impure animal charcoal in muriatic acid. To the solution, filtered from the insoluble residuum, carbonate of soda was to be added, which would precipitate *pure carbonate of lime*. Now, the merest tyro in chemistry knows that the inorganic constituents of bones consist of about 80 *per cent.* of *phosphate of lime*, which would be the per centage of that substance in the *precipitate* thus produced, and held up by the *learned* editors of the *Pharmaceutical Journal*, and their correspondent, as being *creta precipitata*.

It would appear that some of their friends, *out of humanity*, had pointed out the absurdity of the process recommended in their Journal; and, consequently, in the following Number, we find a *mean attempt* to explain away the stupidity exhibited, by inserting the article above-mentioned. They there state, that they had *intended* to have *appended* "the paper *now* inserted" to the article published in the *former* Number.

We find that their scientific appendix abounds as much in proof of their chemical *attainments* as the former article, which they now "*repudiate*." They observe, that "the presence of phosphate of lime in this product (*i. e.* in the precipitate obtained by carbonate of soda in the before-mentioned acid solution) may be *detected* by dissolving the powder in nitric or hydrochloric acids, and adding solution of ammonia, which will precipitate phosphate of lime." Here is a discovery, by these *profound* editors, in analytical chemistry, to wit, that ammonia producing a precipitate in a solution is a

proof of the *presence of phosphate of lime!* Oh, ye disciples of Klaproth, Vanquelin, and Rose, learn from Messrs. Bell and Redwood, the *sages of the Pharmaceutical Journal*, the aforesaid important truth, and dismiss from your minds the lessons you have received from those once-honored adepts in chemical science, that *ammonia gives precipitates*, and white ones too, in *many other* solutions besides those of phosphate of lime.

I am, Gentlemen,

Your obedient servant,

LATE A PUPIL OF LIEBIG, BUT NOW A MEMBER OF THE PHARMACEUTICAL SOCIETY.

IMPORTATION OF COCHINEAL INTO ALGIERS: DESCRIPTION, REARING, AND PROPAGATION OF THIS INSECT.*

BY M. SIMOUNET.

EVERY year France pays to foreign countries from nine to ten millions of francs for the cochineal she consumes. Being impressed with this important consideration, M. Simounet wished to take advantage, for the national benefit, of the knowledge which a stay of a year in Spain, in the environs of Valencia, had enabled him to acquire concerning the rearing and propagation of cochineal. He thought that it would be a great service to France to introduce this precious insect into her African possessions, where it ought easily to prosper, in a climate exactly similar to that of the South of Spain. Braving, therefore, the rigor of the Spanish laws, which condemn to death those who export cochineal, he set out from Valencia, furnished with everything necessary for the execution of his projects.

His first endeavors were not successful, but his perseverance triumphed over all difficulties, and he was enabled, in 1840, to obtain 500 grammes of cochineal of the finest quality.

At his instigation, several agriculturists of Algiers devoted themselves to the breeding of cochineal, and a model *nopalerie* was established in the experimental gardening of Algiers, by the care of Mr. Hardy, its director.

The Government itself appears to take an interest in these useful attempts, and the possibility of acclimating the cochineal in Algiers is no longer a problem, thanks to the zeal and enlightened perseverance of M. Simounet.

We extract these details from a pamphlet which our colleague sent to us, and in which he has carefully described the physical characters of male and female cochineal, and has noticed the progress to be followed for their *education* and propagation. We do not hesitate to borrow from him, on these different subjects, some curious documents, and which should inspire so much the more confidence, as they are for the most part the result of his own observations.

Description of Cochineal.

I. PHYSICAL CHARACTERS OF THE MALE COCHINEAL.

The male cochineal differs totally from the female.

The male cochineal is a dipterous insect, having two transparent wings, six legs, each terminated by a small and very sharp nail; two antennæ, composed of nine articulations, and covered with a silky down; and six black and immovable eyes.

Its red body is covered with a white powder; its abdomen is terminated by two white and silky fillets. From the head to the extremity of the abdomen, its length is 1 millimetre; its size is that of an oblong louse.

The growth of the male cochineal is not the same as that of the female. Like the latter, it fixes itself to the cactus, but its body does not take the same development. Instead of growing bigger, it is covered with a down, by exudation, which down, in the space of six weeks, forms a *shell*. The two fillets which are observed at its posterior part, answer no other purpose than to keep the shell constantly open; and at the period of fecundation, six weeks after its birth, it goes backwards from its shell, and flies about from female to female, then it dies and disappears.

II. PHYSICAL CHARACTERS OF THE FEMALE COCHINEAL.

The female cochineal presents the appearance of an elliptical pea. Its body is composed of rings whose number is undetermined, and which gives it the aspect of an annelide recoiled on itself. Its color is of a deep brown.

Its body is surmounted with a white and pulverulent down, which, being impervious to water, serves to protect it from rain.

Its legs are six in number, formed of two articulations, and each terminated by a pointed nail.

It has also two cylindrical antennæ, composed of three articulations, the last of which is rather longer than the others.

Between the two anterior legs are found the organs of nutrition. These organs are composed of a small gland surmounted by a canal of the diameter of a hair, and of a red color, a sort of trunk which it introduces into the cellular system of the plant which nourishes it.

Some observers have pretended that the

* *Journal de Pharmacie*, February, 1844.

cochineal is born after the death of its mother; that the body of the latter served only as an envelope for a number of eggs which, after her decease, begin to hatch. It is quite otherwise.

The cochineal is really and positively viviparous, and living when she produces her little family, of which I reckon the individuals, not at the number of 632,777, as a Spanish author has done, but at about 300.

The female cochineal alone will occupy our attention here, as she alone forms the commercial product, or red tinctorial substance on which such value is set. It is with her that carmine, lacs of every shade, rose, red, &c. &c., are prepared. It is one of the most precious colors employed in the art of dyeing. In this respect, it is deserving of more attention than has hitherto been paid to it.

EDUCATION AND PROPAGATION OF THE COCHINEAL.

Selection of the Cactus.

The cochineal thrives perfectly well only on the *cactus coccinellifera*, and that for several reasons.

In the first place, the hairy surface of the vegetable greatly facilitates the peregrinations of the delicate young insect. If a little wind rises, not only do its little claws fasten to this kind of small down, but, moreover, its body, bristled with a multitude of points, attaches itself strongly to the velvety tissue of the *nopal*, and is retained in this manner: it is proved that the African cactus can propagate the cochineal, but with less advantage, because the least wind may carry away the insect.

Moreover, the *cactus coccinellifer* produces a fruit always of a yellow color; and, according to Pelletier's analysis, this vegetable contains the coloring matter of carmine, and the insect exhausts it of its precious color.*

ARRANGEMENT OF A NOPAL.

In order to establish a *nopalerie*, it is necessary to arrange in ridges a piece of ground, as much as possible sheltered from the north wind, and to take care to remove every weed.

Some cuttings of cactus nopal are previously procured, and are exposed for some days in the open air, in order to allow the cicatrix of the freshly cut part to dry. The summer is the most favorable season for this plantation.

A first line is drawn with a rope, planting each slip at the distance of one metre from each other. The second line should be two metres apart from the first, and so on, in order to facilitate the gathering.

In order to raise the cactus nopal conveniently, it is necessary—

1. To water the plants every fortnight, in summer.

2. To turn up the earth once a year with the pickaxe or plough.

3. To remove the fruits of the nopal, as they appear, in order that the body of the vegetable may not lose its qualities.

4. To allow the nopals to attain only the height of a metre and fifty centimetres, giving them the form of an even tail two-thirds open. For that purpose, when the rackets shoot, those must be removed which by their weight incline towards the ground, or take too much of a horizontal direction.

When arrived at the proper height and perfectly nourished, the nopals may be used for the propagation of the cochineal.

III. MODE OF PLACING THE COCHINEAL ON THE CACTUS.

In Spain, small cylindrical sheaths are prepared for this purpose, six centimetres long and two broad, open at one end. To make these sheaths, the palm leaf is selected, so that the weaving of these leaves leaves at each junction of the woof a small opening sufficient to allow a little insect to pass through.

This little sheath should contain a dozen of the female cochineal; fifteen of these cases are arranged and afterwards fixed on the cactus by means of small thorns from the *cactus ferox*.

Every metallic point should be avoided, as it wounds the plant, and causes it to perish.

The period when the cochineal is produced, is recognised by a small drop of a colored substance at the posterior part of the insect. This is the time for gathering.

IV. MODE OF COLLECTING THE COCHINEAL.

The cochineal is collected in the following manner:—

In the first place, we detach with great care a quantity of cochineals destined for reproduction, which should be in proportion with the number of cactus to be supplied, and this cochineal is put aside in the cases of which we have spoken, and which is applied to the cactus after it has been properly washed and brushed. This first operation terminated, sheets are spread on the ground, under the cactus, and with a small switch of palm all the insects which remain on the nopal are knocked down; this cochineal is the product. Three crops of cochineal may be made per annum: in May, July, and October. After each crop, it is necessary to

* I have, however, obtained cochineal of very fine quality, which had been brought up on the African cactus.

clear the nopals with brushes, and even to wash them, in order to remove all the white matter which the preceding cochineal deposited. With such care at every crop, the cactus may serve for the propagation of the insect for five or six years.

V. MODE OF STUFFING COCHINEAL.

Several means of stuffing cochineal are given. In Spain, boiling water is adopted; simple exposure to the sun has been proposed, and desiccation by the furnace on plates. But all these modes are equally imperfect, and sensibly altered the quality of the coloring matter.

I therefore propose the following matter, which seems to me most convenient in all respects: it consists in stuffing them in the sand-bath, and drying them by exposing them in the shade by a strong temperature. The quality obtained by this process is equal to the finest and most esteemed cochineal of commerce.

ENEMIES OF COCHINEAL.

The enemies of cochineal are first small conical snails, which fix on the nopal, and which it is easy to destroy by inspecting the *nopalerie* every week. It is the same with a small cochineal, called by the Spaniards *pintillos*. This insect is very dangerous, and effects great ravages. The greatest trouble in a *nopalerie* is to behold its destruction. The eggs which produce the larva of this cochineal—for it is in the state of larva that it destroys the cochineal—are found ordinarily at the foot of the cactus.

There is another insect, which I have observed, however, only in Africa, and against which it is necessary to guard in a peculiar manner, that is the lepisne; this is introduced into the little cases in which are placed the mothers which are to populate the nopal, and devours them. This inconvenience is obviated by closing with a piece of muslin the opening of the cases, after the introduction of the insect.

It is therefore to the vigilance of an experienced and attentive eye, that the welfare of a *nopalerie* must be entrusted.

When the stability of affairs in Africa shall permit industry (the source of all riches) to seriously occupy itself with the products peculiar to its climate and soil, then the oils will flow from it in abundance; cotton and tobacco will be of French growth; the trees of all the zones will gratify us with their products, the lentisque, which is now appreciated only for its shade, will give us its mastic in tears; and its foliage, instead of becoming the prey of flames at the baker's, will supply our tanneries.—I think I have accomplished the task which I set myself. By following the instructions which I have just given here—instructions which I have myself obtained from the best sources—the proprietors of Algiers may be certain beforehand of the success which will crown their endeavors. For my own part, I shall esteem myself too happy, if I have been able to be of some utility.

FORMULA FOR TINCTURE OF SESQUINITRATE OF IRON.

BY WILLIAM ONION.

It is my intention, in the following article, to introduce to the notice of medical practitioners and others, a preparation which ought to supersede the tincture of sesquichloride of iron of the London Pharmacopœia. Of the unfitness of this preparation any one may convince themselves, by procuring samples from different houses, or even from the same house, at different times, and contrasting one with the other; but I need not enlarge on this point, as it has been sufficiently dwelt upon elsewhere.

The formula is as follows:—Take of iron filings ʒss., nitric acid (S. G. 1·5) ʒij. ʒij. (troy weight); digest in a flask, assisting the operation, if necessary, by means of a moderate heat: when the action has ceased, add hydrochloric acid (S. G. 1·16) ʒvj. (troy weight); give the mixture a gentle boil; afterwards let it cool; then add rectified spirit of wine ʒviij.: filter. The affinities that are in operation may be expressed by 16 (N + 5O) and 8 Fe = 8 ($1\frac{1}{2}$N' + $1\frac{1}{2}$ O + Fe) and 4 (N + 2 O) evolved in the state of gas: the only essential use of the hydrochloric acid, is to render and preserve the preparation perfectly bright, as I have found from numerous trials, that, without this acid, it quickly becomes turbid, and cannot, without great care, be prepared so as to retain *all* the sesquioxide of iron in solution. It will be perceived, that the tincture of sesquinitrate of iron contains in each fluid ounce 88 grains of sesquinitrate of iron, equivalent to about 30 grains of sesquioxide, or 20·8 grains of metallic iron.

This preparation will be found an equally, and, in my opinion, a much more efficient medicine than the tincture of sesquichloride of iron, as its uniform strength can be relied upon; it is not liable to spontaneous changes, and will not be found to vary in color, &c., if prepared by the above directions, and will be the best method of exhibiting the sesquioxide of iron in solution.

This tincture has a reddish brown color, styptic acid taste, and, if evaporated, yields a deliquescent mass; its dose is the same as for the tincture of sesquichloride of iron.

The persesquinitrate of iron can only be obtained in crystals, by the method noticed by Vanquelin, by leaving nitric acid for a long period in contact with the black oxide of iron. The crystals form in the liquid, and are transparent and colorless; but when kept, acquire a brownish tinge. Their taste is astringent and acid, and they redden vegetable blues, very deliquescent, and, when heated, melt in their water of crystallization, acquiring a deep reddish brown color. They are composed, according to Dr. Thomson, of—

1½	atoms nitric acid.....	= 81
1	,, sesquioxide iron	= 40
8	,, water.....	= 72

TESTS FOR ARSENIC.

A COURSE of two Lectures will be delivered on this most important subject by Dr. M. Rosenthal; the first on the 12th, and the second on the 19th of April inst., at half-past eight, p.m., in the London Mechanics' Institution, Southampton-buildings, Chancery-lane. The lecturer intends to explain, in a popular manner, elucidating by experiments, the contrivances calculated to discover very minute quantities of arsenic; and chiefly to dwell on the meritorious and ingenious test of Mr. Marsh. We cannot but anticipate valuable instruction, and highly recommend our readers, and especially the medical jurists, to avail themselves of the opportunity afforded.

Tickets are to had at the Library of the Institution daily, from eleven a.m. to ten p.m.

ANALYSIS OF VESICAL CALCULI.*

BY E. BERNOT.

AMONG the numerous analyses tending to characterise the chemical nature of many urinary concretions, we find none which present the slightest resemblance to those observed in a calculous patient, who, treated several times by the method of lithotrity, was constantly cured.

At the time of his admission into the hospital, the urine was reddish, turbid, and powerfully ammoniacal, leaving an abundant deposit by cooling. After he had been in the hospital for some weeks, the urine became less dark colored, transparent after emission, marking 1·05 degrees of the urinometer at 80·6°F. becoming opalescent by cooling to 59°F., and measuring 2·01 degrees of the urinometer. By settling, it deposited calcareous salts, mixed with a large proportion of animal matter (decomposed mucus of the bladder).

Being desirous of knowing the proportions of matter constituting these vesical concretions, I made the following analysis:—

I. One gramme, carefully weighed, lost by calcination, in animal matter and moisture,—

Loss.....	0.4770
Calcareous residue...	0·5230
	1·0000

II. Two portions of the 5,230 of calcareous residue gave—

Phosphate of magnesia..	0.1040	0·1050
,, lime.....	0.2060	0·2050
Carbonate of lime.....	0.2130	0.2130
Uric acid, traces.....	,,	,,
	0·5230	0·5230
Loss by calcination =	0·4770	0·4770
	1·0000	1·0000

HOW TO CONCOCT AN ARTICLE FOR THE "PHARMACEUTICAL JOURNAL."

A FORMULA to enable Members and Associates of the Pharmaceutical Society to write Articles for their Journal, or Papers to read before the Society, upon the Plan invariably adopted and approved by the Editors of that Journal and the *Council* of the Society, with the President's Form for a Speech:—

Commence by saying, this is a very important subject; and then proceed to observe, that Dr. Pereira says—Dr. A. J. Thomson mentions, &c.—Dr. Christison observes, &c.—Dr. Duncan alludes, &c.—Mr. R. Phillips asserts, &c. &c.—Mr. Brande considers, &c. &c.—Dr. Paris writes thus, &c. &c.;—and, when it is wished to appear very learned, quote from Soubeiran, Berzelius, and Liebig; and conclude by saying, that you have not at present pursued your *investigations* any further, but hope to do so shortly.

The President will then declare, that the Society is much obliged to you for this very interesting paper; but that we must not, on any account, deviate from the London Pharmacopœia.

W. B.

* *Journal de Pharmacie*, February, 1844.

THE FORTHCOMING MEDICAL REFORM BILL.

To the Editors of the Chemist.

Gentlemen—

It is understood that Sir James Graham is about to introduce his long-promised Bill to reform the medical profession, "and all that pertaineth thereto." At present, those most interested in the measure are, of course, ignorant as to its nature and extent. One thing, it is hoped, it will take especial cognizance of, and that is the sale of drugs by any persons who have not been apprenticed to, or regularly brought up in, the business. A great deal of mischief is done by the sale of drugs and chemicals by ignorant and unqualified persons, such as grocers, oilmen, cow leeches, quacks, &c. &c., and there ought to be a clause to the effect, "that after a certain time a penalty will be imposed on any such persons so offending."

Another clause ought to have reference to Sunday trading. It is really shameful that assistants and apprentices should be kept in on the Sabbath for the sake of adding a few shillings to their employers' returns.

Some of the members of the Pharmaceutical Society, I understand, of all others, are mean enough to keep up the system alluded to, instead of honorably setting a better example. I am quite aware that some competent person ought always to be at home to dispense medicine when required; but why should the shops make such a display on the Sunday, almost rivalling the gin shops in the show and glare of light?

In conclusion, Gentlemen, allow me to ask you, if the Pharmaceutical Society, instituted for the special protection of chemists and druggists, is preparing for the warfare which may be anticipated from the Bill in question, or is at as *soporific as ever?* I am, Gentlemen,

Yours, respectfully,

March 14, 1844. J. T.

MILAN PLASTERS.*

BY M. E. SOUBEIRAN.

	Grammes.
℞ Resin of elemi, Liquid storax	125
Yellow wax	150
Camphor	30
Cantharides in fine powder	250

The resin and the wax are melted together, and the storax is added, then the cantharides, and the whole is kept on a very gentle fire for half an hour; at the end of this time it is removed from the fire, and the plastic mass is agitated with a spatula until nearly cold, and the camphor is then incorporated. This plaster is of good consistence, and promptly and surely produces vesication. The Milan plasters are most frequently prepared on black taffety.

This formula was communicated to me by M. Louradour. The following is one for which I am indebted to the kindness of M. Ménier :—

	Grammes.
℞ Burgundy pitch	1,500
Resin of elemi	300
Galipot	400
Liquid storax	700
Yellow wax.....	700
Powder of cantharides	1,400
Powdered camphor.....	160
Essence of lavender	6

F. S. A.

M. Monchon has also published a formula, which I have given in my *Traité de Pharmacie*, and which is very good: it is as follows :—

	Grammes.
℞ Resin pitch	250
Yellow wax	250
Lard	250
Powder of cantharides	250
Turpentine	64
Essence of lavender	4
,, thyme	4

F. S. A.

This plastic composition is spread on black taffety. It is employed as a derivative against fluxions, pains in the head and eyes, and rheumatism; one or two plasters are applied to the place, and covered with a compress. They are removed only when they cease to produce a secretion of serosity, and when they detach themselves: they are renewed when wanted.

* *Journal de Pharmacie*, Feb. 1844.

DISPENSARY FOR THE TREATMENT OF DIABETES, CALCULUS, &c.

We have received a prospectus of an Institution, which has lately been established in London Wall. That such a dispensary has not before been established is matter of some surprise to us. The objects are good; and we consider it well deserving of the support of those whose means enable them to aid in the relief of the poor afflicted with the various disorders of the urinary system. We are confident that many of our readers will unloose their purse strings in favor of this charity, and we shall be happy to find this appeal responded to.

We must add, that "Subscriptions will be thankfully received by the Treasurer, T. Sydney, Esq., Leyton House, Essex, and 8, Ludgate-hill; the Secretary, H. Empson, Esq., 27, Bucklersbury, or 27, Regent-square; and Messrs. Hankey and Co., bankers, 7, Fenchurch-street;" and we hope they will speedily receive plenty.

CURE FOR EPILEPSY.*

M. Lemoine has successfully treated three cases of epilepsy by the administration of the following mixture:—Liquor ammoniæ, twelve minims; syrup of orange flowers, one ounce; distilled water of linden flowers, two ounces; and distilled water of cherry-laurel, half an ounce—for a mixture. The first case was that of a man, thirty-six years of age, who was seized with epilepsy in 1841, a month after a fall. When M. Lemoine was called to him, in 1842, he had at least four or five fits during the week. He took four of the above mixtures in the space of three months, and has not since had an attack. The second patient, a dress-maker, thirty-five years of age, was seized with epilepsy in 1838, a few weeks after having been terrified with a drunken man, during menstruation. From that time she remained subject to very frequent attacks, which were, however, we may remark, suspended during a pregnancy. In December, 1842, she began the treatment, and had no fit from that time until the beginning of April. The third patient, a nail-maker, forty years of age, had been subject to severe epileptic attacks for the last twenty years. He had generally four or five during the month. He began the use of the mixture in the first days of January, 1843,—three table-spoonful a-day; and from that time to the 8th of April, 1843, experienced no return of the epileptic fits. He only once, in February, had a slight vertigo, which did not last more than five minutes.

The active principles in M. Lemoine's formulæ, are the ammonia and the prussic acid contained in the laurel water. The quantity of the latter, however, is so small, that we cannot attribute to it much influence over the morbid state of the economy. Ammonia, as nearly every other medicine, has been tried repeatedly in the treatment of this dire disease, and has failed. Still we are so utterly powerless in most cases of epilepsy, that no remedy, which is brought forward as a successful therapeutic agent, should be dismissed without having been tried in the manner in which it is stated to have succeeded.—*Révue Médicale.*

* From *The Lancet.*

TARTAR EMETIC IN PROTRACTED LABOR.*

Dr. Gilbert, writing in *New York Journal of Medicine*, recommends the administration of this remedy in those cases of labor which are protracted by "insufficient action of the womb and rigidity of the os tincæ." These conditions are most frequently found to occur in patients of "tense fibre and rather robust constitution." Bleeding not having had the desired effects, and ergot of rye not being approved of, the author was induced "to make a trial of tartrate of antimony and potass, in doses of half a grain the first portion, and then a quarter of a grain every fifteen minutes, until emesis; as soon as retching commenced the uterine contractions strengthened, and the labor terminated speedily." He says, "I have frequently used the tartar emetic since, and always with the most satisfactory results."

Dr. Ramsbottom speaks favorably of the same remedy. It must be administered in doses sufficient to keep up nausea. Dr. Gilbert, in the same Journal, describes the effects of

STRYCHNINE IN INFLUENZA.†

He says, "The influenza made its first appearance, during the present season, in Gettysburg, Pa., about the 1st of July. The disease was characterised by the usual symptoms. In two cases severe nervous ear-ach was the leading symptom; in one case, periodical neuralgia of the supra-orbital nerve came on every morning at eight o'clock. Observation soon convinced us that this disease in the commencement had its seat in the nervous system, which was in a state of depression, and that after this the mucous tissue was the next to suffer. Having succeeded with strychnine in many of those diseases denominated neuroses, in which there was no inflammation or congestion of the nervous centre, we supposed that in this affection its use might be followed with results equally favorable. We have since exhibited it in a number of cases with excellent effects, always first subduing any local inflammation which might be present."

POISONING BY THE LOLIUM TEMULENTUM, WITH THE MEANS OF DETECTING THIS SEED WHEN MIXED WITH WHEAT FLOUR.‡

BY GIOVANNI RUSPINI.

The author was charged with the analysis of some bread which had rendered ill twenty

* *The Lancet.* † *Ibid.*

‡ *Journal de Chimie Médicale*, Feb., 1844.

women employed in a silk manufactory. These women, after having eaten it, were seized with somnolency, with an universal convulsive tremor, accompanied by coldness of the extremities.

When this bread was presented to him, it was grey, compact, heavy, and of a disagreeable odor, and reminded the author of the examples of adulteration by means of alum or sulphate of copper with wheat flour; but he did not find the characters which these salts present. He then thought of the lime and of the arsenic which agriculturists employ in the operation of liming; then he proceeded to analysis, and he found in the bread a greater quantity of lime than is ordinarily met with, which he attributed to the water used in its preparation. He then asked for a sample of the flour, thinking that it might contain some organic principle which might have been altered or disguised by the action of fire; but he experienced considerable delay in procuring it, and in the meantime the manager of the manufactory in which the women were employed went to the baker, and, after reproaches and threats, obtained from him the avowal that the miller had sometimes furnished to him flour containing lolium. The physician, thinking that he recognised the symptoms of poisoning caused by this substance, administered emetic and emulsions, and all the symptoms were soon dissipated. The affair rested here. However, says M. Ruspini, in my quality of pharmacien, although I was no longer professionally engaged to make investigations relative to this case, I immediately began to make experiments in order to distinguish pure wheat flour from that mixed with lolium. My method of analysis is simple, and capable of being put in practice by persons unacquainted with science. It consists in digesting for half an hour alcohol at 35° at the ordinary temperature, with half an ounce of wheat flour; the more pure it is the more limpid will the alcohol remain; then it will take only a more or less deep straw color, according as the flour contains more or less of the pericarp and embryo passed through the sieve, owing to the carelessness or design of the miller. The alcohol will be colored yellow by dissolving the peculiar resin which the *Triticum hybernum* contains, and which resides in the pericarp. The taste of the alcohol thus colored will not, however, be disagreeable; it will even be rather sweet. If, on the contrary, alcohol be digested with flour mixed with the seeds of the lolium, the spirit of wine will immediately acquire a characteristic greenish tint, which will gradually become deeper; the taste of the tincture will be astringent and disagreeable to the extent of exciting vomiting. Evaporated to dryness in a porcelain capsule, it will give as a product a greenish-yellow resin, possessing the same characters as the tincture, but more powerful, and so evident as to leave no doubt as to the adulteration in question.

Some reflections follow concerning the infamy of such a fraud, and the necessity of punishing it, by publishing the names of the bakers who allow it, in the public journals.

In a note, the author says that the arsenic used in the liming is decomposed by the earth, and that the plant cannot preserve any trace of it.

In a second note, he announces that this year, the rains having been very abundant, before the putting forth of the ears, all the *bad* herbs, particularly the lolium, grew abundantly in the fields, rendering it necessary to sift the corn with much care.

ON THE ADULTERATION OF VINEGAR BY SULPHURIC ACID.*

BY PROFESSOR GARNIER.

It is known, that dilute sulphuric acid, by aid of heat, converts fecula first into *dextrine*, and, if the heat be contained, into *glucose* or grape-sugar. It then loses the property of turning blue with iodine.

In the first case, this reagent colors it of a vinous violet, and in the second, there is no coloration at all. The alteration which sulphuric acid causes fecula to undergo, is regarded as a disaggregation. According as disaggregation is more or less advanced, the coloration by iodine changes in tint, and, when there is no longer any coloration, disaggregation is complete. These properties of fecula may be turned to account for detecting the presence of sulphuric acid in vinegar, the adulteration of vinegar by this acid being very common, as M. Chevallier has observed.

Before giving an account of the precision of this assay, two samples of vinegar are taken, the one pure, and the other containing a very small quantity of sulphuric acid (if it contain only $\frac{1}{100}$th it will be easily detected); about half a grain of fecula for 100 cubic centimetres, or one grain of vinegar, and the mixture is heated in a phial.

After about ten minutes, the presence of sulphuric acid may be perceived. By testing these two liquors separately by tincture of iodine, in pure vinegar, the coloration is blue as usual, and in the other it presents a violet tint, which approaches vinous red.

If the ebullition of vinegar be continued,

* *Journal de Chimie Médicale*, February, 1844.

and if the assay be repeated with a small quantity, the coloration seems to become more and more vinous, whilst that of pure vinegar always remains the same. Finally, after twenty or thirty minutes' boiling, the adulterated vinegar is no longer colored by iodine.

If we called to mind the action of sulphuric acid on fecula, it is evident that the small portion which the above-mentioned sample contained, were sufficient for obtaining the total disaggregation of the fecula, whilst pure vinegar had no action on it.

ANALYSIS OF THE BLOOD IN A CASE OF LEAD COLIC.*

BY PROFESSOR COZZI.

HAVING been charged with the analysis of a certain quantity of blood, taken from a subject attacked with lead colic, Professor Cozzi sought to ascertain whether this liquid contained salts or oxides of lead, and whether these substances were combined with all the proximate principles of the blood, or only with some of them.

He detected the presence of a salt and an oxide of this metal, and he found, moreover, that, instead of being combined with the hæmatosin, the periglobule, and the fibrin, they entered into combination with the albumen.

This analysis, which supports the theories already published by Schuebler, Berzelius, Lassaigne and Taddei, is the first by which we have been made acquainted with which of the proximate principles of the blood lead really enters into combination.

[The analyses which we made with M. Brichetau, of the urine of white lead makers attacked with lead colic, showed that these urines contained salts of lead.—A. CHEVALLIER.]

THERAPEUTICAL EMPLOYMENT OF CHLORIDE OF SILVER.†

BY DR. PERRY.

THE chloride of silver, already recommended by Poterius as an anthelmintic and hydragogue; by Hoffmann as evacuating from the *pituitus* in cases of dropsy and melancholy; by Zachinius as an excellent remedy, associated with sulphuret of antimony, for mania, melancholy, and epilepsy; and finally, in latter times, by Professor Serres against syphilis. Chloride of silver has also been employed in several pathological cases, by Dr. Perry.

This practitioner declares that he finds it preferable to the nitrate, because it is more certain in its effects, more easily applied, less liable to decomposition, and without disagreeable taste.

Chloride of silver succeeds best under the form of pills. However, for young children, it may be prescribed in the state of powder, or in suspension in an appropriate syrup.

The internal use of this salt does not determine the greenish or brown coloration of the skin like the nitrate.

Dr. Perry prescribes this chloride in epilepsy. The dose in which he ordinarily administers it, in cases of this kind, is 15 *centigrs.* four or five times a day. The effects are more marked than those of nitrate of silver.

He gives it also in chronic dysentery, commencing with 25 *milligrammes* three or four times a day, and gradually raising the dose to 10 or 15 *centigrs.* at each administration. Under the influence of this medicine, the number of motions and all the other symptoms very soon abate.

Menstruation, even when it has been suppressed for a long time, is repaired by action of chloride of silver, provided that its employment be sustained for two or three weeks, in the dose of 5 to 15 *centigrammes.*

Dr. Perry has also found its employment beneficial in the secondary symptoms of syphilis.

POISONED SALT.*

IT is stated in a letter from La Haye that more than 80 inhabitants of that town have lately been poisoned from having used salt procured from a manufactory at which it was sold at a very low price. From chemical experiments, it has been ascertained that this salt contained arsenic in the proportion of a fifth of its weight. The cause of this mixture, which might have caused the death of so many persons, is unknown. Hitherto, only one of the victims has died: there is some hope of saving the others.

BELLADONNA IN PAINFUL MENSTRUATION.†

DR. G. BIRD drew the attention of the Medical Society to that form of dysmenorrhœa which was unaccompanied by organic change, or attended by the discharge of shreds from the uterus, and in which the pain was referred to

* *Giornale per Servireai Progressi.*
† *The American Medical Intelligencer.*

* *La Presse*, December 18, 1843.
† From *The Lancet*, March 23, 1844.

the lower part of the abdomen, immediately over the uterus. In these cases he had found belladonna, properly prepared, of the greatest efficacy. When the patient was of a leuco-phlegmatic habit, pale and chlorotic in appearance, he ordered five grains of extract of bellodonna and twenty grains of sulphate of zinc, to be divided into twenty pills, and of these one was ordered to be given immediately on the accession of pain, and repeated every two or three hours, until the pain ceased. When the patient was plethoric and of full habit, he substituted ten grains of ipecacuanha for the zinc, and the pills were given in the same manner. In the intervals of menstruation purgatives were administered, with medicines tending to improve the general health. This treatment he had scarcely ever known fail.

Mr. Pilcher had found belladonna and ipecacuanha very serviceable in cases of hooping-cough. In neuralgia of the face morphia and quinine, and of the breast, belladonna or the liquor cinchonæ, were the best remedies.

Dr. Waller had used belladonna alone, both externally and internally, in cases of dysmenorrhœa, with temporary relief. He applied it externally in the form of a plaster of the simple extract spread on adhesive plaster. He had seen the belladonna in conjunction with hydrocyanic acid, in the proportion of one grain of the extract to five minims of Scheele's preparation, four or five times a day, of great benefit in cases of severe gastrodynia. He had found the belladonna also of great service in various anomalous neuralgic pains.

Dr. Garrard had used belladonna in the forms mentioned by Dr. Bird, and in the second set of cases, attended by plethora, had, instead of the ipecacuanha, often usefully substituted colchicum. Belladonna and quinine he had found of service in cases of gastrodynia.

The President had found the belladonna plaster very useful in cases of subcutaneous painful tubercle.

GAMBOGE AND CHIMAPHILA IN DROPSICAL AFFECTIONS.

To the Editors of The Chemist.

Gentlemen—Having found the following formulæ of singular benefit in the species of dropsy arising from tubercular disease of the kidneys, you may probably think it worthy of a corner in your pages.

The dose of gamboge may appear, in the opinion of many, too small to produce any marked result. On this subject I shall only remark, that minute doses of that gum invariably act as an antispasmodic. Whether this action has ever yet been noticed, I am not aware: it is, however, nevertheless, a fact.

I remain, Gentlemen, your obedient servant,

W. Hamilton Kittoe, M.D.

25, Thayer-street, Manchester-square,
March 20, 1844.

℞—Potassæ Hydriodatis.. ℈ij.
Tinct. Opii ..... ℥ss.
Decoct. Chimaphilæ.. ℥vj.

Two or three table-spoonsful to be taken at morning, noon, and night.

℞—Pulv. Jacobi Veria ..... xxiv. gr.
Hydrarg. Chloridi .... viij. ,,
Pulv. Gum Cambogi .... xij. ,,
Extract. Hyoscyami .... ℈ij.

Divide into 16 pills; one to be taken every night.

The Chimaphila, otherwise known by the name of the Pyrola Umbalata, has not been sufficiently noticed by the profession in this country. It is a well known and very popular remedy amongst the negro population in the West Indies; and I have found it of great efficacy in every species of dropsical affection.

IV. REVIEWS AND NOTICES OF BOOKS.

MEDICINES, THEIR USES AND MODES OF ADMINISTRATION; INCLUDING A COMPLETE CONSPECTUS OF THE THREE BRITISH PHARMACOPŒIAS, AN ACCOUNT OF ALL THE NEW REMEDIES, AND AN APPENDIX OF FORMULÆ. By J. Moore Neligan, M.D., Physician to Jervis Street Hospital, and Lecturer on Materia Medica and Therapeutics in the Dublin School of Medicine. Dublin: J. Fannin and Co. London: Longman and Co. 1844.

Our readers will find this a most useful work; a large amount of information is carefully condensed into a moderate space. As a book of reference, it will be found of the greatest utility to the physician, the apothecary, the druggist, and the student.

The arrangement adopted in this work, is based on the ultimate medicinal effects of remedial substances.

Chap. I., treats of Antacids; II., Anthelmintics; III., of Antispasmodics; IV., of Astringents; V., of Cathartics; VI., of Caustics; VII., of Diaphoretics; VIII., of Diuretics; IX., of Emetics; X., of Emmenagogues; XI., of Emollients; XII., of Epispastics; XIII., Errhines; XIV., of Expectorants; XV., of Narcotics; XVI., of Refrigerants; XVII., of Sedatives, or Contra-stimulants; XVIII., of Sialogogues;

XIX., of General Stimulants; XX., of Special Stimulants; XXI., of Tonics; XXII., of Supplementary Agents.

Appendix A contains a number of formulæ, principally confined to the new remedies described in the work, or to those not yet in general use.

Appendix B consists of a valuable posological table.

We copy from the author's preface an outline of the plan adopted in describing each medicinal substance:—

"1st.—The officinal appellation and English name of each article is given; and, in the case of vegetable substance, the native country and Botanical Classification of the plant from which it is obtained. For the advantage of the student, the most important characters of each medicinal plant are also concisely described.

"2nd.—The Physical properties.

"3rd.—The Chemical properties.

"4th.—The mode of preparation. Under this head the processes of the three British Pharmacopœias are given in full.

"5th.—The adulterations, and the manner in which they may be detected.

"6th.—The therapeutical effects, and the uses of the substance in the treatment of disease.

"7th.—The dose and mode of administration. Under this head all the officinal preparations of the British Pharmacopœias, as well as many of those ordered by the Continental and American Colleges, are introduced.

"8th.—The incompatibles.

"9th.—In the case of poisons, the antidotes and mode of treament."

The foregoing extract will enable our readers to judge of the utility of the book, and the following will serve as an example of the mode in which Dr. Neligan has carried out his plan:—

"Aloe, L. Aloe socotrina, D. E. *Aloes; Socotrine aloes; From* (*Inspissated juice of the leaves of*, L.) *Aloes spicata*, D. L.;—*of an undetermined species of Aloe*, E.

"Aloe hepatica, D. Aloe barbadensis, E. Aloe indica, E. *Hepatic aloes; Barbadoes aloes; Indian aloes.—From aloe vulgaris*, D. *Extract or inspissated juice of one or more undetermined species of Aloë*, E. The Edinburgh College correctly states, that aloes is obtained from various species of the genus Aloe; they are inhabitants of the East and West Indies, Socotora, Barbary, and the Cape of Good Hope; and belong to the Natural family *Liliaceæ*, and to the Linnæan class and order *Hexandria Monogynia*.

"B. C.—The species of the genus Aloe from which the drug is obtained, are generally characterized by having woody stems, with large, fleshy, amplexical, leaves, glaucous, flat above and convex below, having marginal spines or serratures; Flowers numerous, in spikes or racemes, tubular colored; stamens exserted.

"P. U. & M. of Prep.—The proper juice of the leaves inspissated; it is obtained by cutting the leaves transversely near their base, and evaporating the juice, which flows spontaneously from them, either in the sun or with the aid of heat; sometimes the flow of juice from the leaves is aided by plunging them in hot water; and sometimes by pressure, when an inferior sort of aloes is obtained; a still worse description is procured by evaporating a decoction of the leaves.

"P. P.—Obtained in those different ways, and from various parts of the world, aloes differs much in their physical properties, consequently several varieties of the drug are met with in commerce. In addition to three kinds admitted by the Edinburgh College, we shall describe a fourth, *Cape aloes*.—1. Socotrine aloes (*Aloe Socotrina*), so named from its being prepared in the island of Socotora, whence it is imported into England either by way of Smyrna or Bombay; it is in masses of a golden-brown color, having a smooth glassy fracture, and a translucent garnet-red hue at the edges; the odor is fragrant and aromatic, much heightened by being breathed on, and the taste is bitter; it yields a powder of a beautiful golden-yellow color which is almost entirely soluble in proof spirit. The following are the characters assigned to Socotrine aloes by the Edinburgh Pharmacopœia; "In thin pieces translucent and garnet-red, almost entirely soluble in spirit of the strength of sherry. Very rare." Socotrine aloes is most probably procured from the *Aloe Socrotina*, it is imported in skins or in chests.—2. East Indian aloes (*Aloe Indica*, E.), is usually confounded, at least in Ireland, with the foregoing variety. It occurs in large opaque masses, of a dark liver-brown color, with a dull, waxy, fracture; the odor is similar to, but weaker than that of socotrine aloes, and the taste equally bitter; it yields a dull reddish-yellow powder, a great part of which is insoluble in proof spirit. It is brought to England in skins and chests from Bombay, but is stated to be originally obtained from the coasts of the Red Sea. It is probably derived from a species of aloe if not identical with, nearly allied to the *Aloe Socrotina*.—3. Barbadoes aloes (*Aloe Barbadensis*, E. *Aloe hepatica*, D), is a product of Barbadoes, Jamaica, and other West

Indian islands, whence it is imported in gourd-shells. It is of a dark liver-brown, sometimes almost black color; the fracture is dull and opaque; the odor strong and disagreeable, resembling that of the human axilla, and the taste very bitter. It is reduced to powder with difficulty, the powder being of a dull dark-yellow color. This variety is obtained from the *Aloe vulgaris*, and probably from some allied species.—4. Cape aloes (*Aloe Capensis*), is imported in skins and in chests from the Cape of Good Hope, and is very common in English commerce although not introduced into any of the Pharmacopœias. It is of a glossy resinous appearance, a dark brown color, with a greenish-yellow shade, especially when in small fragments, a strong disagreeable odor much increased by breathing on it, and an acrid bitter taste; it is very brittle, and readily reduced to powder, which is of a shining, greenish-yellow color. It is procured from the Aloe spicata, and several other allied species.

"C. P.—The most important constituent of aloes, is a bitter extractive matter (*Aloesin*, Pfaff.), amounting in the finer sorts to nearly 80, in the inferior to about 50 per cent.; it is probably the active principle of the drug. The finer sorts of aloes contain also resin, and a peculiar acid (*Aloetic acid*, Pereira). In addition to those substances, the inferior sorts contain some vegetable albumen. Aloes is almost completely soluble in boiling water, but as the water cools a dark brown substance insoluble in cold water is deposited; it is very sparingly soluble in rectified spirit, but dissolves almost entirely in proof spirit, and still more readily in weaker spirit; heated, it fuses imperfectly, and if the heat be continued is converted into a resinous looking, very friable mass.

"*Adulterations.*—The only adulteration of aloes is, the mixing the inferior sorts with, or substituting them for, the finer kinds; of this we can judge by the physical characters, particularly the odor when breathed on, or by the solubility in weak spirit.

"Th. E.—In moderate doses from three to ten grains, aloes acts as a stimulating cathartic, influencing especially the large intestines, on which it operates rather by exciting their peristaltic action, than producing increased secretion from their mucous membrane. It produces its effects more slowly than most other medicines of this class, from ten to eighteen hours usually elapsing before it operates. The specific action of aloes on the large intestines contraindicates its employment in hœmorrhoidal affections, in irritation or inflammation of the pelvic viscera, the prostrate gland or the urethra, in pregnancy and during the menstrual discharge. From its mode of operation it is also evidently not adapted for cases in which we wish to produce increased secretion from the intestinal canal, or where a speedy operation is required. The employment of aloes as a purgative, is, nevertheless, very general; and perhaps there are few vegetable cathartics more extensively used. In torpor of the intestines, especially when accompanied with deficient secretion of bile, it is the most useful of this class of remedies; indeed by many it is said to be the best substitute for that secretion, and is therefore exhibited in jaundice when unaccompanied with hepatic inflammation, mechanical obstruction of the ducts, &c. In habitual costiveness so common in females, aloes is also administered with much benefit, due attention being paid to the circumstances which contraindicate its employment. Christison states, that the cathartic property of aloes is much increased by its combination with sulphate of iron, and that its irritating action on the rectum is counteracted by combining it with extract of hyoscyamus.

"D. & M. of Adm.—*Aloe socotrina*, D. L. E. *Aloe indica*, E. gr. iij. to xv.—*Aloe hepatica*, D. *Aloe barbadensis*, E. gr. ij. to gr. v. It is best administered in the form of pill, made with honey, mucilage, &c.—*Extractum Aloe hepaticæ*, D. *Extructum Aloes purificatum*, L. ("Prepared as the simpler extracts," D.—"Aloes, powdered, ℥xv.; boiling water, cong. j.; macerate for three days with a gentle heat; strain, allow the fœces to subside; pour off the clear liquor, and evaporate to a proper consistence;" L.). Dose, gr. v. to gr. xv.; this is a useless preparation, when we can obtain good aloes.—*Pulvis Aloes cum Canella*, D. (Hepatic aloes, lbj.; canella alba, ℥iij.; rub together to powder and mix); *Hiera Picra;* formerly much used as an emmenagogue, but little employed now; Dose, gr. vi. to gr. xviij.—*Pulvii Aloes comp.*, D. L. (Hepatic (Socotrine, L.) aloes, ℥iss.; guaiacum resin, ℥i.; aromatic powder (compound cinnamon powder, L.), the ℥ss.; rub the aloes and guaiacum separately to powder, and mix in the aromatic (cinnamon, L.) powder.) A stimulating cathartic not much used. Dose, gr. x. to ℈i.—*Pilulæ Aloes*, E. (Socotrine aloes; and Castile soap of each equal parts; conserve of red roses, q. s.; beat into a proper pill mass). —P. (Aloes, ℥ iv.; soap, ℥vi.; oil of anise, gtt. viij.; syrup, q. s.; mix). Dose, gr. x. to ℥ss.—*Pilulæ Aloes comp.*, D. L. (Hepatic (Socotrine, L.) aloes (powdered L.), ℥i.; extract of gentian, ℥ss.; oil of caraway, min. xl.; simple syrup, a sufficiency; mix). An excellent habitual purgative. Dose, gr. v. to gr. xv.—*Pilulæ Aloes cum Myrrhâ*, D. L. E. (Hepatic (Soco-

trine, L. Socotrine or East Indian, E.) aloes (powdered, L.), ʒij. (4 parts, E.); saffron, ʒj. (1 part, E.); myrrh, ʒi. (2 parts E.); syrup (conserve of red roses, E.), q. s.; beat to a proper mass). *Rufus' Pills.* An excellent stimulating cathartic and emmenagogue. Dose, gr. x. to gr. xx.—*Pilulæ Aloes et Assafœtidæ*, E. (Socotrine or East Indian aloes; assafœtida; and Castile soap, equal parts; conserve of red roses, q. s.; beat to a proper mass). Cathartic and antispasmodic. Dose, gr. x. to gr. xv.—*Pilulæ Aloes et Ferri*, E. (Sulphate of iron, 3 parts; Barbadoes aloes, 2 parts; aromatic powder, 6 parts; conserve of red roses, 8 parts; pulverise the aloes and sulphate of iron separately, and beat into a proper mass, which is to be divided into five grain pills). Tonic and cathartic, well adapted for chlorosis. Dose, one to three daily.—*Pilulæ ante cibum*, P. (Aloes, 6 parts; extract of cinchona, 3 parts; canella, 1 part; syrup of wormwood, q. s.; divide into four grain pills). One or two before dinner.—*Decoctum Aloes comp.*, D. L. *Decoctum Aloes*, E. (Extract of liquorice, ʒss. (ʒvij., L.); carbonate of potash, ℈ij. (ʒi. L.); hepatic (socotrine, L. or hepatic, E.) aloes, bruised (powdered, L.); myrrh, bruised (powdered, L.); and saffron, of each, ʒi. (ʒiss. L.); water, *by measure*, lbj. (Oiss. L.); boil together down to fʒxij. (Oi., L.), strain and add of the compound tincture of cardamoms, fʒiv. (fʒviij., L.). A mild cathartic with tonic properties; Acids, acidulous, and most metallic salts are incompatible in prescription with it. Dose, fʒss. to fʒij.—*Vinum Aloes*, D. L. (Socotrine aloes, (rubbed to powder, L.), ʒiv. (ʒij., L.); canella bark (powdered, L.), ʒj. (ʒiv., L.); sherry wine, *by measure* lbiij. (Oij. L.); (proof spirit, *by measure* lbj. D.); macerate for fourteen days with frequent agitation, and strain).—E. (Socotrine or East Indian aloes, ʒiss.; cardamom seeds, ground; and ginger, in coarse powder, of each, ʒiss.; sherry, Oij.; digest for seven days, and filter). A warm purgative. Dose, fʒss. to fʒii.—*Tinctura Aloes*, D. L. E. (Socotrine (or East Indian, E.) aloes, powdered ʒss. (ʒi., L. E.); extract of liquorice, (dissolved in ʒviij. of boiling water, D.), ʒiss. (ʒiij. L. E.); proof (rectified, L. E.) spirit, *by measure* ʒviij. (Oss., L. fʒxij., E.); (water, Oiss., L. fʒxxviij., E.); digest for seven (fourteen, L.) days, and filter). Cathartic and tonic. Dose, min. xxx. to fʒss.—*Tinctura Aloes comp.*, D. L. *Tinctura Aloes et Myrrhæ*, E. (Socotrine (or East Indian, E.) aloes, powdered, ʒiij. (ʒiv. L. E.); tincture of myrrh, *by measure*, lbij. (Oij.; and saffron, ʒij., L. E.); macerate for fourteen (seven, E.) days, and filter). Stomachic and cathartic. Dose, fʒss. to fʒij.—*Enema Aloes*, L. (Aloes, ℈ij.; carbonate of potash, gr. xv.; decoction of barley, Oss.; mix and rub them together). A useful stimulating cathartic in the constipation of Amenorrhœa; also employed for dislodging ascarides from the rectum."

LESSONS ON CHEMISTRY, FOR THE USE OF SCHOOLS, JUNIOR STUDENTS IN THE UNIVERSITIES, AND READERS WHO WISH TO LEARN THE FUNDAMENTAL PRINCIPLES AND THE LEADING FACTS. By William H. Balmain. London: Longman and Co. 1844.

A more useful or more judiciously prepared work, we have seldom met with; we propheey that it will do much to extend a knowledge of chemical science, and that it will be a great boon to those who like an easy method of acquiring knowledge.

Each lesson is followed by some questions for examination.

We strongly recommend this book to parents and schoolmasters, and to those who would combine pleasure with improvement.

The following extract is given as an example of the simple manner in which the author convey instruction:—

"A whole or piece of any thing, whatever its size or shape may be, and however hard or soft it may appear, is a portion of matter.

"The smallest portion of matter which we can see, may be divided into parts: nevertheless, we do not suppose that matter may be divided indefinitely, but that it consists of a number of indivisible particles. These indivisible particles are called atoms, the word atom being derived from two Greek words signifying something which cannot be cut.

"An atom is of the same size, shape, and weight, at all times, and under all circumstances.

"A portion of matter consists of a great many atoms held together more or less firmly according to circumstances.

"A portion of iron consists of a great many atoms of iron; a portion of water of a great many atoms of water, &c.

"There are spaces between the atoms of matter.

"Cohesive attraction is a force which tends to bring the atoms of matter nearer to each other.

"Heat tends to drive the atoms farther from one another.

"Heat and cohesive attraction constantly act in opposition to each other.

"Certain amounts of heat and cohesive attraction neutralise each other.

"A crystal or crystallised substance is a portion of matter, the atoms of which are arranged in straight lines inclined at certain angles to one another.

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Taylor (A. S.)—A Manual of Medical Jurisprudence, including Toxicology. 8vo. cl. 12s. 6d.

Baudrimont (A., M.D.)—Traité de Chimie générale et expérimentale avec les applications aux Arts, à la Medècine et à la Pharmacie. Tome. 8vo. 9fr.

Garnier et Harel (MM.)—Des Falsifications des Substances Alimentaires et des Moyens Chimiques de les reconnaître. 12mo. 4fr. 5c.

Berzelius (M.)—La IVme. année du Rapport Annuel sur les Progrès de la Chimie. Presenti le 31 Mars, 1843, a l'Academie des Science de Stockholm. 8vo. 5fr.

Dumas (J.)—Memoires de Chimie. 8vo. 7fr. 50c.

——— et Boussingault. — Essai de Statique Chimique des êtres organises. 3me. ed. 8vo. 3fr.

Johnson (C. W.)—On Manures. 2nd ed. 8vo. 16s., cl.

Reid (D. B., M.D.)—Illustrations of the Theory and Practice of Ventilation. 8vo. 16s., cl.

Johnston (J. F. W.)—Catechism of Agricultural Chemistry. 1s.

Kemp (G., M.D.)—A Letter to Professor Liebig on some Misrepresentations contained in the Second Edition of his Work, "Animal Chemistry." 8vo. 1s. 6d.

Francis (G.)—Electrical Experiments illustrating the Theory, Practice, and Application of the Science of Free, or Frictional Electricity, containing the Methods of making and managing Electrical Apparatus of every description. 8vo., cl. 3s.

Dumas (M. J.) and Boussingault (M. J. B.)—The Chemical and Physiological Balance of Organic Nature. 3rd edit. 12mo., cl. 4s.

BOOKS RECEIVED.

"Annalen der Chemie und Pharmacie." Jan. 1844. From Professor Liebig.

"Chemical Investigation of the Organic Bases in Coal-gas Naphtha." By Dr. Augustus William Hoffmann, Assistant in the Giessen Laboratory. Translated from Liebig's "Annalen," by James Sheridan Muspratt, of Seaforth-hall, Liverpool.

"The Chemical and Physiological Balance of Organic Nature." An Essay, by M. J. Dumas and M. J. B. Boussingault, Members of the Institute of France. 3rd Ed. With new Documents. London: H. Baillière, 219, Regent-street.

REPRINT OF THE FIRST VOLUME OF "THE CHEMIST."

In consequence of the increased and still greatly increasing sale of The Chemist, we have determined on reprinting the First Volume, which has been out of print for nearly three years. The New Edition will be ready with our May Number. As only a limited number of sets will be made up, orders must be given early, in order to prevent disappointment.

TO CORRESPONDENTS.

M.D.—We have done as you requested.

An "Investigator" need be under no such fearful apprehensions.

"A Yorkshire Farmer."—Guano.

Y.—Not that we are aware of.

X. Y. Z. will receive a letter by the 2nd inst.

"A Subscriber," Fulham.—No; not at present.

"A Water Drinker."—We have no space for such trash.

"A Manufacturer."—One guinea.

M. P. S.—We are on the alert.

"A Physician of the Old School" adheres to a very good principle.

Those Correspondents who are not answered in the present Number, will be attended to in our next, or answered by post, as the case may be.

Erratum in the Present Number.—In H.'s letter, page 160, column 2, line 16 from bottom, for "Fareham" read "Fincham."

Bright's Custard Powder.—We are gratified in being able to add our testimonial to the already published long list in favor of the excellence of the custard powder prepared by Mr. Bright, of farinaceous celebrity. It is really a very useful, simple, and delicious compound, and, unlike most other luxuries, the ingredients are so easy of digestion, that the most delicate invalid may use it in perfect safety. It is also highly nutritious.

SUMMARY OF METEOROLOGICAL OBSERVATIONS MADE AT OTLEY, YORKSHIRE, IN JANUARY AND FEBRUARY, 1844.

BY E. THOMPSON.

JANUARY.

BAROMETER.

Monthly mean	29·78
Mean at 9 a.m.	29·78
,, 3 p.m.	29·78
,, 9 p.m.	29·77
Maximum on 15th	30·25
Minimum on 6th	28·94
Range	1·31

THERMOMETER.

Monthly mean	36°
Mean of maxima	40
,, minima	33
Maximum on 5th	50
Minimum on 3rd	20
Range	30

WIND.

Days.		Days.	
N.	0	S.	1
N.E.	0	S.W.	5
E.	1	W.	18
S.E.	1	N.W.	3

RAIN.

1·59 inches.

WEATHER.

Days.		Days.	
Clear	5	Snow	4
Cloudy	9	Frost	11
Overcast	0	Mist	1
Showers	9	Hurricane	1

GENERAL REMARKS.

The temperature of this month has been about the mean for a number of years, and the weather very changeable.

There have been no long-continued storms. On the evening of the 29th occurred a violent storm of wind from the south-west, which has occasioned some damage to buildings, &c.

Infantine diseases continue to prevail.

FEBRUARY.

BAROMETER.

Monthly mean	29·40
Mean at 9 a.m.	29·39
,, 3 p.m.	29·40
,, 9 p.m.	29·41
Maximum on 16th	30·01
Minimum on 26th	28·48
Range	1·53

THERMOMETER.

Monthly mean	32°
Mean of maxima	35
,, minima	29
Maximum on 16th	45
Minimum on 26th	23
Range	25

WIND.

Days.		Days.	
N.	1	S.	1
N.E.	1	S.W.	2
E.	2	W.	9
S.E.	0	N.W.	7

RAIN.

1·94 inches.

WEATHER.

Days.		Days.	
Clear	4	Frost	19
Cloudy	4	Hoar frost	0
Overcast	1	Mist	0
Showers	3	Hurricane	0
Rain	8	Lunar halo	1
Snow	16	Hail	1

GENERAL REMARKS.

Very severe weather has prevailed throughout the month. There have been two heavy falls of snow, which, however, did not remain on the ground a long time. On the 26th the barometer fell to 28·48. Hooping cough, catarrh, and febrile diseases, have been extensively prevalent.

NOTA BENE.—*All Communications, Books for Review, and Substances to be Analysed, must be addressed "To the Editors of the Chemist, 310, Strand, London." Communications must be prepaid, and sent before the 15th of each month; Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

A LECTURE, INTRODUCTORY TO A COURSE ON CHEMISTRY, IN THE UNIVERSITY OF PENNSYLVANIA.*

DELIVERED NOV. 7, 1843, BY ROBERT HARE, M.D., PROFESSOR OF CHEMISTRY.

How much is it beyond the human mind to form an adequate idea of the universe, in which we have been placed by the fiat of our Creator? Can any language be hyperbolical when applied to that of which both the extent and the endurance are necessarily unlimited; and of whose profound and intricate laws the utmost efforts of human reason can attain only an inadequate knowledge?

What an infinitismal is man and all his works; nay, even the planet on which he resides, when compared with innumerable solar systems, probably on the average not inferior in importance to that of which the earth measures less than one millionth part! Yet how influential upon his happiness are those portions of the elementary constituents of this universe, which, though individually impalpable, incessantly act upon him corporeally and mentally through his taste, smell, feeling, hearing, or sight? What pleasures or pains, what mirth or melancholy, what hope or despair, what joy or sorrow, what mental and bodily disease, do they not directly or indirectly occasion; either by acting from without, or by modifying his physiological constitution?

As respects the self-propagation of his species, as well as the necessity of food and respiration, man has over other mammalia no superiority. What mainly distinguishes him, is a capacity to acquire and avail himself of knowledge and skill.

The temporal habitation of the human soul, consisting of the same elements as the inanimate portion of the creation, the soul is impelled to obtain a knowledge of that corporeal habitation, and of those surrounding bodies, however vast or minute, on which it is dependent for a life more or less painful or pleasing, more or less happy or miserable, according to the knowledge acquired of good and evil.

And how enormous is the difference, which the acquisition of skill and knowledge has made in the wealth and power of mankind!

What a revolution did chemistry effect, in the relative superiority of the barbarian and civilised man, by the discovery of gunpowder! Compare the bow, the javelin, catapulta, balista, or battering-ram of the ancients with modern fire-arms. Would not one ship of the line be an over-match for those hostile navies, of Carthage and Rome, on the result of whose strife the establishment of an immense empire to endure for ages depended? Doubtless the steam frigate Princeton, with her gallant officers and crew, and Stockton's gigantic gun, could run down or blow into pieces as many galleys as were engaged in the celebrated battle of Lepanto, on the fate of which possibly hung that of Christendom.

In its influence on the balance of national power, the expansive force of steam may rival that of the explosive chemical compound, to which allusion has been made. The daring population of the extensive valleys of our great western rivers, having access only to a few unhealthy sea ports, could never have become competent to the acquisition of a maritime power, requiring a large number of sailors; consequently, there never could have arisen an ability to secure a communication with the Atlantic in opposition to any great maritime nation. But now that steam is the means of propulsion, the vast territory to which I have alluded may become possessed of a navy of steamers, which may not only secure their predominancy on the

* Communicated to THE CHEMIST by Dr. Hare.

gulf, but may enable them to contend with success for ascendancy in any part of the ocean.

But to proceed with other points of view, in which knowledge and skill have added to human wealth and power, let us compare the spinning wheel or hand loom, with the spinning jenny or steam loom; the work done by an amanuensis of old, with that accomplished by a modern printer; the process for papyrus with that for the manufacture of paper; the mule, pack horse, or wagon, with the railway car, or canal boat; the nautical ability of an ancient Palinurus, gazing at the stars, heaving the lead, or scanning a coast which he was afraid to lose sight of, with a modern navigator; who, provided with a compass, sextant, chronometer, and almanac, enjoys as much security, while lying to in the middle of the Atlantic, as when moored in a harbor.

Let the phenomena of Chemistry, Electricity, Galvanism, and Electro-magnetism be arrayed before us; with the teleseope of the astronomer and the microscope of the naturalist. Let a due consideration be given to those myriads of impalpable animalcules of which the number is as much too large for the mind to conceive, as they are individually too small for unassisted vision to discover.

Let the mind's eye be directed to that nucleus of red hot lava on the shell of which we reside. Let us endeavor to form an idea of the sun, the glorious king of day of the poet, the Deity of the Persian and the Peruvian, of all idols the least irrationally made the object of worship. This tremendous fiery globe, the pivot of our solar system, is so vast, that were its centre coincident with that of the earth, its surface would be twice as far from that of this planet as the orbit of the moon; and yet, agreeably to the lowest estimate of the diameter of Arcturus by Herschel, and latterly by Bessel, its size is thirteen hundred times as great as that of the sun, although only one-eleventh of the size of Sirius. It should simultaneously be kept in mind, that the enormous solar mass, to which I have called attention, is self-supported by its own sluggishness or inertia, and spontaneously pours forth a never ceasing torrent of heat and light, without any extraneous supply of fuel. Meanwhile about the immense solar sphere thus constituted, with a velocity four hundred times as great as that of a ball shot point blank from a cannon, our little planet of red hot lava, encrusted with earth, revolves annually, while diurnally rotating on its axis, and turning with the moon, every month, about a common centre of gravity situated at the distance of two thousand miles from the terrestrial surface.

Lastly, let us think of the dimensions, of the distances, the motions of the sun, his planets, and the stars called fixed, erroneously; since, as Herschel has sublimely conceived, in order to generate a centripetal force competent to counteract the gravitation, which would cause every existing body to rush towards a common centre of gravity, the whole must revolve about that centre. May it not be at once a pleasing and reasonable idea, that from the central space about which this suggested revolution takes place, the Deity, sublimely enthroned, commands a panoramic view of a revolving universe? Is it unreasonable to imagine, that one of the enjoyments of those whose virtues may entitle them to eternal happiness, may be that of a humble participation in this celestial privilege?

But of all wonders, the greatest is how any thing came to exist; *since, if ever there was nothing, there never could have been any thing. If nothing ever was, nothing would have for ever endured.* Hence the eternity of God is inevitable; and, as respects the age of the universe, it is now admitted by some of the most enlightened among the teachers of revealed religion, that our comparatively little globe has undergone changes requiring an inconceivable time for their accomplishment. In truth, next to the absurdity of supposing a rational universe without a reasoning being to rule over it, were that of supposing such a being without a universe to control. This would involve the idea of the endurance of the Almighty for an infinite antecedent time, without objects of attention commensurate with his wisdom, his power, and goodness. Under such circumstances, would not these attributes be as nugatory as if they were annihilated?

A few years since, many of the more inconsiderate among the reading portion of society were carried away by an account respecting certain experimental observations made by an enthusiastic electrician, to believe in the generation of certain insects through the influence of the voltaic current. It struck me at first, that, as nothing less than the miraculous interposition of the Deity could give rise to animal life, this narrative must be a jocular fiction—like the statement respecting certain observations of Herschel, in aid of which the light of the hydro-oxygen blow pipe flame was employed to co-operate with the solar rays in illuminating bodies, on the lunar surface, at the distance of more than two hundred and thirty thousand miles!

It was, nevertheless, true, that an equivocal description had been given, in good earnest, tending to create the idea that animals had been generated by a voltaic current

out of silicious earth, alkali, and acid. It subsequently appeared, not that certain species of acari or lice had been created, but that they had been *stimulated to exhibit themselves* by the agents and apparatus employed. According to my apprehension, it had been quite as practicable to repeat the Mosaic miracle, of bringing water from a rock by the blow of a rod, without supernatural aid, as to create sentient organised beings by the materials and apparatus employed by the electrician. Far more reasonable were it to expect the formation of a watch by subjecting the ores of the metals requisite for its construction to the voltaic process.

Perhaps human genius has in no instance approached more nearly to the production of a machine having the attributes of an animal, than in the construction of the locomotive steam engine, of which the furnace may be considered as performing the office of a stomach, the cylinder and pipes that of the bowels, while the shaft, levers and wheels act as limbs; but still the will, the instinct, the power of self-reproduction, and the heaven-born sense of existence, are deficient.

In fact, human efforts have never attained the point of making a self-moving machine, or perpetual motion, however wrong-headed projectors may have deceived themselves and others with false expectations of success in that impracticable project. For, although there be in nature incessant movements, like those of the planets, or of waves, &c., and currents which, originating from calorific, or electrical changes, move or flow without intermission from age to age: such sources of motion are not to be created by man.

But it is time that I quit this lofty speculative region, into which I have been rambling, and descend to subjects of a more practical bearing on the science which I am to teach.

Less than a century ago, four simple bodies, hydrogen, oxygen, carbon, and nitrogen, now known to constitute organic substances, with the help, comparatively, of a minute quantity of inorganic matter, had not been recognised as elements; carbon alone having been isolated in the states of diamond or charcoal. In the last mentioned state, carbon must have been noticed as soon as fires were made, and in the pure state of the diamond was the object of admiration at an early age. Yet, less than fifty years since, when the poet Gifford wrote, the allegation of its identity with diamond was satirised. A similar incredulity simultaneously existed as to the formation of water by the union of two gases.

The property which oxygen has of converting hydrogen into water, and carbon or charcoal into carbonic acid gas, while with nitrogen it does not unite, excepting under peculiar circumstances, has of late been made use of to analyse organic substances by heating them with a compound capable of imparting oxygen sufficient to saturate their hydrogen and carbon. The process being performed in a tube of refractory glass, the aeriform products are made to pass successively through other tubes and bulbs containing solids or liquids, of which the one absorbs the carbonic acid, the other the water. The respective quantities of these products taken up, are subsequently ascertained by weighing.

This process was originally suggested by Gay Lussac and Thenard, but has been simplified and improved by Liebig.

In consequence of a great number of analyses thus effected by the chemist last mentioned, and various co-laborators, the organic branch of chemistry has been so extended and modified, both as respects facts and hypotheses, that it now occupies as large a space in elementary treatises, as all the rest of the science, including inorganic chemistry, together with the auxiliary branches of statical, voltaic, and magnetic electricity. Under these circumstances I propose to occupy a part of the time allotted to this Lecture with some remarks suggested by some of Liebig's physiological speculations.

In these I conceive he has in various instances been bold, hasty, inconsiderate, and inaccurate,* but still has advanced many ingenious ideas which are likely to be highly serviceable to physiological chemistry. He has quite as much merit in holding up ideas, before existing, in a new and popular form, as in suggesting such as are altogether original. Yet I would liken him to a military leader, who, after marching through a country, with drums beating and colors flying, should have his trumpets loudly sounded, as if a complete conquest had been effected; while leaving behind him many fortresses, of which the knowledge had prevented more cautious and considerate leaders from having previously undertaken the same expedition. Nevertheless, by these means the philosopher of Giessen has excited a degree of attention, in the great mass of physicians and agriculturists, which had never been gained, had he neither deluded himself nor the readers of his essays with the prospect of an elucidation of the mysteries of animal and vegetable physiology, which it is beyond the present state of chemistry to afford. Moreover, the popu-

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* For what I consider as a palpable instance of an inversion of the truth, I refer to my "*Pamphlet on the salt radical theory*," page 21. Also Silliman's Journal, vol. 45, page 259, Oct. 1843.

larity which he has thus gained, may lead others to follow in the same path, who may rectify his errors and remedy some of his omissions without impairing what is really true in his doctrines.

There can be no better exemplification of the errors to which Liebig is addicted, than his adoption of the following maxim:—"*There are many ways to the highest pinnacle of a mountain, but those only can hope to reach it who keep the summit constantly in view.*" It must be evident to every person of any experience, in ascending mountains, that although it may be necessary to keep the *bearing* of the summit in *mind*, our eyes must be upon the path; and that, in most cases, the safest and easiest mode of access, causes the summit to be concealed for a time. A person who should implicitly follow Liebig's advice would probably fall over some precipice, or tumble into some fissure which might escape notice while keeping the summit of the mountain *constantly* in view. Is not the fallacious rule of action above quoted a good figurative illustration of a theorist, who, keeping his mind too much upon some hypothetical acme, overlooks insurmountable objections which a close attention to facts would make evident? Has not Liebig exemplified his own course?

Some of the excellent practical suggestions with respect to agriculture, which are to be found in Liebig's work, are not the less worthy of being tried in practice because they owe their origin to Sir Humphry Davy. I allude to the necessity of attending to the chemical constitution of soils and manures, so that one may be of a nature to correct the defects of the other. All that Liebig alleges of the reagency of gypsum, of ammonia, bone earth, urine, carbonic acid, and of the alkalis, seems to me well worthy of attention, though partially inconsistent with the experimental inferences of Dr. Jackson, a distinguished American chemist.*

Ordinary fires being supported by the union of atmospheric oxygen with the charcoal and the hydrogen of fuel, while the respiration of animals is attended by a union between atmospheric oxygen and the carbon of the blood, it has long been apparent that a large consumption of oxygen must be thus necessarily occurring. On the other hand, the observation that from the leaves of vegetables, exposed in water to the solar rays, a copious emission of oxygen ensued, and the fact that carbon was found largely to enter into their composition, led very naturally to the inference that animals inspire oxygen, and give out carbon, while vegetables respiring the gaseous compound formed with carbon by oxygen, called carbonic acid gas, emit oxygen, retaining the carbon.

But some contradictory observations had caused this view of the subject to be represented as incorrect; and the question has always been undecided. Liebig has with great ability taken that side of this question, to which I have always adhered.† He considers that the carbon in vegetables is due to the absorption of carbonic acid, and infers that it is thus that the enormous consumption of oxygen by fires and animal respiration is compensated. He shows by calculation that, agreeably to analysis, there are three thousand millions of millions of pounds of carbon in the air, in the state of carbonic acid, and infers that the carbon in all the mineral coal known bears but a small proportion to that thus existing in the aeriform state.

It is known that inland plants yield by incineration, potassa, the active matter of common soap ley. Plants on the borders of the ocean yield soda, an analogous substance. In various species of grain, certain salts are found to exist always in a certain ratio. Now, however minute are the proportions of these substances, Liebig correctly avers, as I believe, that their absence incapacitates a soil for the successful cultivation of the kind of plant requiring them.

This distinguished chemist concurs with the celebrated Davy in representing plants as taking up all soluble matters presented to their roots in a sufficiently diluted state, but

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* "Doctor Jackson is of opinion that the ammoniacal salts act in a different way from that stated by Liebig—that the carbonate of ammonia acts upon the organic matters of the soil, and renders the organic acids neutral and soluble—decomposes and renders inert noxious metallic salts and other compounds.

"Dr. Jackson objects that Liebig has not produced any instance where a plant has been raised by a solution or other preparation of ammonia in a purely silicious or other pure earthy soil. This question is, therefore, open for research, and experiments have been instituted to decide it. (That ammonia, in the state of carbonate, or in solution in water, has a great effect in stimulating plants, has long been known to gardeners; but they also know that the plant so treated soon perishes. It would seem to be an analogous case to that of plants stimulated by chlorine, but not supplied with a proportionally increased allowance of food.)"—Webster's edition of Liebig's Organic Chemistry, p. 411.

† This side of the question has been experimentally supported by Professor Daubeny, of Oxford, England.

appears to be peculiar in the opinion that it is only that portion of carbon which is in the state of gaseous carbonic acid which forms their food.

According to Davy, Berzelius, and others, vegetable matter, constituting humus orgeine, yields certain acids which, being absorbed, are the means of nutrition. But both Davy and Liebig, the latter especially, consider that carbonic acid is imbibed by the vegetable foliage, the carbon being assimilated and the oxygen exhaled. Of course water is all important, and appears to be received through the leaves, as well as the roots.

Lignin, which constitutes the fibres of wood, hemp, flax, and those of plants in general, also sugars, gum, starch, and other analogous vegetable products, consist merely of water and carbon. Nitrogen exists in plants in comparatively small proportion; yet its presence appears to be of primary importance, since it has a sort of ubiquity in the organs and juices. But although this element forms nearly four-fifths of the atmosphere, it seems to be generally conceded, and is by Liebig urged, that it is not directly obtained from that source by vegetation. According to this philosopher, a previous conversion into ammonia, by a union with hydrogen, is requisite; this alkali, and the carbonic acid with which it unites, when exposed to the atmosphere, being mainly the food of plants. But though nitrogen pervades vegetable organisation, it abounds in a larger proportion in that of animals: hence it has been a question how animals, *feeding on vegetables only*, are supplied with a sufficiency of nitrogen. It naturally occurred, in the case of vegetables, that they might derive it from the atmosphere during respiration; but experimental investigation has shown that there is no absorption of nitrogen during that process tending to justify this inference.

Thus, in the supply of nitrogen to the vegetable and animal creation, Nature, from considerations which are inscrutable to human reason, prefers an indirect and precarious source to one which is superabundant and always at hand. Nor is this the only instance. Fishes, which swim in an element consisting of eight parts in nine of oxygen, are dependent for this principle on the contact of their gills with a minute portion of air absorbed from the atmosphere.

But Liebig alleges that, as a large portion of vegetable diet merely serves to yield the carbon required for respiration, there is, in the residue, a due proportion of nitrogen to form flesh and blood; since it has been shown by recent analyses that in beans, wheat, and other grain, there are substances capable of isolation, which are identical in composition with the fibrous matter of the blood or fibrin, and with serum or white of egg, called albumen, also with milk curd or casein. Thus animals find ready formed in some parts of vegetables, if not in all, the ingredients of their flesh and blood. But some of the most abundant articles of vegetable food, such as sugar, starch, gum, fat, oil, &c., being devoid of nitrogen, cannot alone contribute to the formation of flesh. They go, says Liebig, to support the fire in the lungs, where thirteen ounces and a half of carbon are, on an average, daily consumed by a man, causing as much heat as would raise three hundred and seventy pounds of water to the temperature of the blood.

It is alleged by the same author that all the oxygen, thus combined with carbon, is in the first instance taken up by the protoxide of iron in the venous blood, which, being consequently changed in color, causes the reddening of the blood ere it passes into the arteries. To this it has been objected that the quantity of iron in the blood is inadequate to take up a sufficiency of oxygen; and it appears to me that were the fact to be as suggested, the heat would be evolved in the lungs where the absorption of oxygen takes place, not in the capillaries where it is transferred to carbon.

Moreover, I am of opinion that, as protoxide of iron is of a more dingy red than arterial blood, it would be incompetent to color this liquid, as alleged, unless assisted by some other agent, such, for instance, as sulpho-cyanhydric acid, which has been heretofore represented as participating in the result.

It would seem, on the whole, that Liebig has, in this respect, contributed more to *enforce* than to *alter* the opinions offered by me on this subject in the former editions of my text book. Yet I have always thought that a machinery so complicated as that employed in the process of respiration could not have been devised merely for the generation of animal heat or the oxidisement of carbon in the tissues, as Liebig seems to believe. It has struck me that the necessity of atmospheric oxygen to fishes would hardly be ascribed satisfactorily to the ponderable matter thus received through their gills, or on any heat which it may produce. I have suspected that there was some imponderable fluid, supplied to the nervous system by the process in question, to which the classes of animals, enjoying the benefits of it extensively, are indebted for the superiority which they obviously possess over animals which do not enjoy that advantage to a similar extent.

One of the greatest services rendered by the author, whose opinions are under consideration, is, as I think, in directing attention

to the different offices performed by two classes of vegetable products which may be distinguished as nitrogenised and as devoid of nitrogen. All the various species of sugar, starch, gum or mucilage, oil, fat, and gelatine, are represented as having a tendency rather to go to the support of the respiratory process, or to produce obesity; while the fibrin and albumen of flesh and blood are sustained by those portions of animal and vegetable food which contain nitrogen in nearly the same proportion as it exists in them. The greater vigor of a horse when fed on oats or maize is in this way explained, by the greater proportion of matter contained in such grain, which is of a nature to compensate the wear of the muscles.

Highly worthy of consideration, also, are Liebig's suggestions respecting the services rendered by theine, a peculiarly highly nitrogenised principle, common both to tea and coffee. Liebig ingeniously shows that this principle requires only an addition of water and oxygen in order to convert it into taurine, an active principle of the bile. The extensive use of tea and coffee by civilised nations thus appears to have been the result of a sort of instinctive empirical research, leading to beneficial results, which physicians were heretofore unable to appreciate or explain. In fact, as food, coffee and tea were heretofore considered as almost valueless; but now it appears that they serve to furnish nitrogen in a more concentrated form to those whose indolent habits might be incompatible with the consumption of sufficient quantity of ordinary nutriment to obtain a requisite quantity of that element.

There is nothing which seems more completely impenetrable to the human mind than the power of vitality. Probably in no instance is this power better exemplified than in the changes which, by means of the vital spark, take place in seeds and eggs. In the latter, especially, the principle of life seems to hold in check those chemical affinities which, so soon as it is extinct, convert into a putrid mass that which, life enduring, would be transformed into a young bird. The vital power of animal and vegetable organisation not only counteracts the conflicting affinities of inorganic atoms: it also endows groups, constituted of little else than three or four of those atoms, with powers analogous to those inherent in simple elementary atoms, and thus extends immeasurably the bounds of useful chemical reaction.

I infer that the organs of animals and vegetables have two modes of effecting the object for which they were created. In one mode, in which chemical reaction would fail to accomplish the requisite transformations, being such as affect masses rather than their component atoms, the organs react directly, in a mode entirely hidden from our view. There is, as Liebig justly alleges of such phenomena, an invisible cause. In the other mode, creating such chemical compounds as are suitable for their purposes, it may more or less leave to these the issue.

Liebig asserts that "we shall obtain that which is obtainable in a rational inquiry into nature, if we separate the actions belonging to chemical powers from those which are subordinate to other influences;" but the learned author does not show us how we may accomplish this separation; and probably for the best possible reason, that, great as are undoubtedly his skill and his genius, he is incompetent to effect any such separation. He seems to forget that he elsewhere admits "chemical powers to be subordinate to other influences, whether of life, of heat, or electricity." To me it seems, that to separate the action of these powers from such as are subordinate to other influences, would involve their separation from themselves; and that it were inconsistent to suppose that chemical agents, which are created by the vital power, cannot be also modified by it so long as it prevails.

"But," says this distinguished author, "the expression vital principle must, meanwhile, be considered as equivalent to the terms 'specific' and 'dynamic' in medicine. *Everything is specific which we cannot explain, while, by the epithet dynamic, everything is explained which we do not understand.*"

This disparaging language, as respects the power of life, seems to me not quite consistent with the following opinions elsewhere stated by the celebrated author.

"Our notion of life involves something more than mere reproduction—namely, the idea of an active power, exercised by virtue of a definite form and production, and generation in a definite form. By chemical agency we can elaborate the constituents of muscular fibre, skin, and hair, but by such means are enabled to create no organised tissue, no organic cell. The production of organs, the co-operation of a system of organs, and their power not only to produce their component parts from the food presented to them, but to regenerate themselves, in their original form and endowed with all their properties, are characters belonging exclusively to organic life, and constitute a form of reproduction independent of chemical powers. The chemical forces are subject to the invisible cause by which this form is produced, and of the existence of which we are made aware only by the phenomena which it induces. Its laws must be investigated just as we investigate those of other powers

which produce motion and changes in matter. The chemical forces are subordinate to this cause of life, just as they are to electricity, heat, and mechanical force. Such is the influence, and no other, exercised by the vital principle over chemical forces."

Thus the author, notwithstanding his contemptuous allusion to the vital principle, and his confounding it in value with words alleged by him to be insignificant, in the passage last quoted, justly ascribes to the principle in question a prodigious efficacy.

In the following passage Liebig's mode of reasoning is exemplified :—"Is it truly vitality which generates sugar in the germ for the nutrition of young plants, or which gives to the stomach the power to dissolve and prepare for assimilation all the matter introduced into it? A decoction of malt possesses as little power to reproduce itself as the stomach of a dead calf; both are unquestionably destitute of life, but when amylin or starch is introduced into a decoction of malt, it changes first into a gummy like matter, and lastly into sugar. Hard boiled albumen and muscular fibre can be dissolved in a decoction of a calf's stomach, to which a few drops of muriatic acid have been added precisely as in the stomach itself. The power, therefore, to effect transformation does not belong to the vital principle. Each transformation *is owing to a disturbance in the attraction of the elements of a compound, and is, consequently, a purely chemical process.*"

But is there any truth in the allegation that in no other than a chemical process, can there be any disturbance in the attraction of the elements of a compound? Is it by a chemical action that an electrical current subverts chemical affinities? Is it by a chemical action that vitality endows chemical compounds with peculiar attractive powers? Has not Liebig sanctioned the opposite idea in the passages which I have cited?

I conceive that plants and animals consist, in the first place, of organs and whatever may be necessary to the preservation or efficacy of their organs; secondly, of substances secreted or excreted by those organs; and, thirdly, of the compounds arising from the reaction of such substances with each other, or with extraneous chemical agents with or without an elevation of temperature. In an egg we have an organic mass possessing on the one hand the wonderful vital power to which allusion has been made, on the other containing albumen, a substance endowed with chemical affinities for certain oxides and chlorides. But the power which albumen has of contributing to the birth of the chicken, is quite distinct from that which, after the vitality of the egg is destroyed, renders it an antidote for corrosive sublimate.* Still more is the power of the yolk to constitute a living being, distinct from that by which, when ignited with potassa and iron, it may give rise to two cyanides, as in the well-known cyano-ferrite of potassium or ferro-prussiate of potassa.

The germination of barley, by means of which it is malted, is so dependent upon the vital principle, that, when spontaneously heated by lying in large masses on ship board or otherwise, it becomes incapable of the process above mentioned. Yet, by this vital process, a chemical change is induced in the organic mass, by which it is more or less transformed into a sweet soluble matter, called, when in solution, wort. This change is effected by the intermediate agency of diastase, a substance elaborated from malt. Thus, besides the greater mystery of life, we have the lesser mystery, of the changes effected by the "action of presence or catalysis," as the process is designated by which diastase, or sulphuric acid, causes starch to be converted into grape sugar, and yeast converts sugar into alcohol and carbonic acid.†

The saccharine matter produced by diastase, or otherwise, may, by nitric acid, be converted into oxalic acid. Thus we have four states in which new organic substances are produced. First, the vital organ, endowed with the germ of a living plant; secondly, an instrument produced by that organ, and possessing a sort of magic power of inducing chemical changes in substances with which it does not combine; thirdly, a chemical compound, elaborated by this chemical magic; and lastly, a product resulting from the reaction of the chemical compound with an inorganic reagent.

Among the greatest wonders of organic chemistry, is the acquisition of power, by elements otherwise inert, from mere grouping. The hempen cable, of which a given section has more strength than an equal weight of iron forming a chain, consists of nothing but water and carbon, into which it is easily resolved by the application of heat. By fire we may fuse or oxidise the iron, and

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* I am, in some degree, indebted to Dr. Kane for the ideas comprised in this paragraph.

† Under the head, "*Lactic or Viscous Fermentation,*" in the Compendium, page 600, I have endeavored to show, that, by Liebig and his disciples, processes are referred to catalysis *as if analogical*, which are actually quite different. See, also, page 602, paragraph 5,979.

thus equally deprive its particles of strength; but, on collecting the resulting fragments, metallurgic skill can elaborate another chain, the cohesive power of the metallic particles having been subdued, not destroyed; but no human skill, unaided by the powers of vegetable life, can regenerate another cable from water and carbon.

Subjected to ultimate analysis, prussic acid, which is so fatal to animals, consists only of three of the ingredients of their flesh or blood. It is constituted of nitrogen one of the elements of the air which animals breathe, of hydrogen one of the elements of the water which they drink, and of charcoal which, *per se*, is inert.

By a proximate analysis, this deletereous acid is found to consist of hydrogen and cyanogen, a gaseous body, formed of one atom of nitrogen and two of carbon, being, therefore, a bicarburet of nitrogen.

Cyanogen is the first discovered of an important class of bodies now called compound radicals by the school of Liebig. These I would prefer to designate as *compound elements*, inasmuch as they are endowed with all the attributes of simple elements. Upon the idea thus exemplified, the existence in organic substances of various other compound radicals, has been inferred; not only when capable of isolation, like cyanogen, but also where they are known only in a state of combination. The discovery of the existence of these bodies forms a new era in our science.

Liebig designates organic chemistry as "*the chemistry of compound radicals.*" Nearly twenty *primary*, or derivative compound organic radicals have been inferred to exist, of which nearly an equal number are severally generators of acids and bases.

By Liebig the diversity of these radicals, as respects properties, is to be ascribed either to the proportions by weight, in which the ultimate elements are present, or, when the proportions of these are equal, to the mode in which they are grouped. But I conceive, that without resorting to the assistance of causes on which heat, light, electrical reaction, and nervous influence are dependent, the proportions or the grouping of their ponderable elements furnishes no adequate cause of the wonderful diversity and astonishing activity of certain organic products.

Agreeably to Faraday's inferences, a grain of water, or a grain of zinc, contains as much electricity as eight hundred thousand square feet of well charged coated glass surface. Admitting that these inferences are greatly beyond a true estimate, with such experimental evidence before us, is it reasonable to overlook the quality of matter on which its electrical efficacy is founded? Of the existence of some potent cause of electrical phenomena, there can be no doubt; and whether it be of one nature or another, certainly it plays a part of infinite importance throughout the creation.

We may have under our eyes two little heaps of powder, conveying to the senses no proof that there is any difference in their composition, or any potency peculiar to either. One of these, subjected to the blow of a hammer, will explode with a startling report, and with violence sufficient to indent the steel; the other will cause, under like circumstances, no similar result; but if swallowed by an animal will be productive of death. A drop of prussic acid may produce an effect no less fatal by falling on the tongue of a dog, constituted of the same simple ponderable elements as the acid. The consequences are more like those of lightning than such as would result from the impression made by a poison, agreeably to the idea of poisons generally entertained.

We have innumerable essential oils, spices, and other pungent vegetable productions, such as cinnamon, pepper, mustard, and horse-radish, which have upon the organ of taste, smell, or feeling, an endless variety of effects. Of the substances thus alluded to, many consist of nearly an equal number of atoms of carbon and hydrogen, while the rest vary only in having, in addition to these ingredients, a small proportion of oxygen. It is quite a mystery how, by the powers of vegetable life, these ponderable atoms are made to acquire such various qualities; but, as in the case of the fulminating powder, I have ascribed the result to the agency of imponderable matter, so in the case of the active substances engendered by vitality, I should make a similar suggestion; their adventitious chemical, medicinal, or poisonous energy being due to the association of imponderable matter with groups of ponderable atoms.

It seems to me rather unreasonable in Liebig to speak so boldl yas he is wont respecting physiological phenomena, while making no effort to explain the part performed by electricity in regard to them. Is there not reason to suppose that he has been so much occupied by the analytical department, that he is not sufficiently aware of the difficulty of doing justice to the electro-chemical department of physiology?

The power of producing all the phenomena of voltaic electricity, which the gymnotous electricus has been fully shown to possess, can leave no doubt respecting the capacity of the animal organisation to generate electricity. It will be admitted that the animal nerves have functions to perform of the highest importance to ani-

mals; and of all known agents is there any which can be conceived to be the medium of their efficacy, excepting the electric fluid, or that cause of electrical phenomena which is usually thus designated.

So long as there is so much evidence of the potentiality of electro-chemical reactions, whatever may be their cause, and so long as we remain ignorant of the manner in which vital, electrical, and chemical forces are associated, is it not premature to expect any satisfactory explanation of the processes of life?

I will for the present take leave of chemical physiology, in order to turn to another topic, which forms a highly appropriate theme to conclude with on this occasion.

It is to be regretted that the rapid progress of chemistry has rendered it less popular with many whose indolence or occupations have prevented them from keeping pace with it. For the very reason that its claims to consideration have augmented, their disposition to bestow on it merited attention has diminished.

Where the attainment of knowledge is inconvenient, it is natural that the value of it should be questioned, as it is easier to adopt and circulate the opinion, that any species of information is unnecessary, than to acquire it. But is it not self-evident, that the more knowledge a physician possesses of the nature of his remedies, the less is he liable to be disappointed by the ignorance or carelessness of those who vend or prepare them; and, consequently, to be misled as to the influence of his prescriptions? And how otherwise could that class of citizens who are to represent their country in the physical department of science, bear a comparison with the same class in Europe, where chemistry is sedulously studied? While we exult when we compare our soldiers and seamen with Europeans, shall we blush at the comparative ignorance of our physicians?

Among the branches of medical science, which have been made necessary to a medical degree, the practice of medicine, surgery, and midwifery are evidently those which are most necessary to the healing art; but it is no less evident that, by reading and attending the practice of a skilful instructor, much progress may be made in these sciences, independently of the assistance of lectures. Familiarity with them must of necessity grow, as practice is extended. These observations are not applicable in the case of chemistry and anatomy, of which, if the student acquire no knowledge while at the University, there is generally little opportunity or leisure for its attainment afterwards.

Neither anatomy nor chemistry can be well learned without the aid of dissections or experimental illustrations, which can but very imperfectly accompany instruction, where a large concourse of students does not stimulate and justify the requisite exertion and expenditure.

Since among all other enlightened nations of the present age, a knowledge of chemistry is deemed essential to a physician, it cannot be otherwise regarded among the people of the United States. Patriotism forbids that medical education shall, in our country, *retrocede* during an epoch signalised in the whole world by its advancement.

Assuming, therefore, that chemistry must be acquired by those who aspire to the honors and emoluments of the medical profession, excepting anatomy, it appears to me more necessary to be taught in our University than any other branch of medical science. If less frequently and imperiously forced upon attention during medical practice, there is the more reason for insisting upon attention to it in our lectures, since, if not thus taught, the deficiency is less likely to be remedied by subsequent study or experience.

To conclude, it should always be kept in view that nothing is much valued which is easily attained; and that in proportion as the qualifications requisite to a medical degree are difficult in the acquisition, and elevated in their nature, so will be the standing and emoluments of those on whom it may be bestowed.

As agreeably to the authority of Euclid, to which I have often appealed, in common with my distinguished colleague, Doctor Chapman, there is no royal way of becoming a mathematician, so is there no easy mode of attaining the rank of a skilful, learned, and eminent physician. Fame can only exist at heights inacessible to ignorance, indolence, and imbecility. The paths which lead to her abode are rugged, steep, and circuitous. All who seek that pinnacle, by the highways of sloth and pleasure, will inevitably find themselves lost in the shades of ignoble obscurity.

ON THE MEANS OF ASCERTAINING THE ADULTERATION OF POTASSA BY SODA, AND DETERMINING, IN A SIMPLE MANNER, THE PROPORTION OF THE LATTER.*

BY E. F. ANTHON, OF WEISGRUN.

THE following prize question, proposed among other subjects by the *Société de*

* *Repertorium für die Pharmacie.*

Pharmacie, of Paris, "*to give an easy and commercial process for detecting the presence and proportion of soda in the potassa of commerce*," induced me to undertake this work.

In order to find a process of this nature, proper for determining the proportion of soda in potassa, adulterated by this alkali, and of giving a satisfactory result, with respect to celerity and accuracy, even in the hands of persons unacquainted with chemistry, it was necessary to submit to a more attentive examination the processes hitherto employed for separating the salts of soda from those of potassa.

A process ordinarily employed in analysis, and which presents also the necessary accuracy, is that of Berzelius: it consists in converting the two alkalis into metallic chlorides, evaporating to dryness, and heating in a platinum crucible to the commencement of redness, and then weighing. The saline mass thus obtained should be mixed with 3¾ times its weight of crystallised chloride of platinum and sodium, which may also be replaced by a solution of chloride of platinum, to which a small quantity of chloride of sodium has been added. It must afterwards be dissolved in very little water, evaporated almost to dryness at a very gentle heat, and then treated by alcohol of 60 per cent. The chloride of sodium is dissolved in it as well as the chloride of platinum and sodium added in excess, and the chloride of platinum and potassium forms an insoluble residue, which must be washed on a filter with alcohol. The chloride of platinum and potassium, after having been washed, is maintained at a very gentle heat, until several weighings show that it loses no more in weight. The quantity of chloride of platinum and potassium obtained, serves for calculating that of the potassa or chloride of potassium. One part of chloride of platinum and potassium corresponds to 0·19334 of potassa, or 0·30565 of chloride of potassium. Finally, the quantity of chloride of sodium is found by subtracting the quantity of chloride of potassium found from the total weight of the two metallic chlorides, and the quantity of soda is then deduced by calculation. One part of chloride of sodium corresponds to 0·53289 of soda.

This process is not at all applicable to the object in question: in the first place, on account of its expense; and in the next place, because it requires an experienced chemist; and also because almost all kinds of potassa contain chloride of potassium or chloride of sodium, or else both chlorides at once, and a more or less inaccurate result must then be obtained, according to the proportion of the two metallic chlorides contained in potassa, if care have not been taken previously to ascertain their quantity, that they may not be reckoned in the second instance.

I have said sufficient to show that this process of separation, however valuable it may be, is not very applicable to the object in question.

Another process of separating potassa from soda has been indicated by Serullas. It is based on the property of perchloric acid, of giving with potassa a compound very sparingly soluble in water and insoluble in alcohol, and with soda on the contrary—a compound very soluble in water, as well as in the strongest alcohol. The operation is ordinarily performed by adding an excess of perchloric acid to the solution containing the salts of potassa and soda, and cautiously evaporating the mixture, almost to dryness. The mass obtained is then treated by alcohol, which dissolves the perchlorate of soda, with the acid which was previously combined with the two alkalis, in the case when the perchloric acid is not driven off under the form of gas, and leaves, on the contrary, the perchlorate of potassa. The two perchlorates are then cautiously calcined, and they are converted, with a disengagement of oxygen, into chloride of potassium and chloride of sodium, which serve for calculating the quantities of potassa and soda.

Although this second process is not so expensive as the preceding, the other objections apply to it; for not only does it require too much chemical skill, but it likewise gives an inaccurate result, since the potassa of the chloride of potassium, and sulphate of potassa contained in the potassa, is found in the result, and because it is necessary, consequently, previously to make an accurate determination of the impurities accidentally or purposely mixed with the potassa.

All the reagents which are now employed for detecting potassa and separating it from soda, such as the tartaric, hydrofluosilicic, and carbazotic acids and sulphate of alumina, are, more or less, liable to the objection of indicating not only the alkali combined with the carbonate acid, but also that combined with the sulphuric and hydrochloric acids, &c., and not being able, consequently, to give an accurate result without a previous and minute determination of the accidental mixtures of potassa.

It should, therefore, rather be possible to find, in the capacity of saturation of potassa and soda, a means of solving the question; for, by comparing the capacity of saturation of potassa with that of soda, we find a very considerable difference. Thus, for example, 100 grains of dry simple carbonate of potassa require for their neutralisation 1,000 grains of pure dilute sulphuric acid (for al-

kalimetry), which contains nearly 8½ per cent. of anhydrous acid, whilst 100 grains of anhydrous carbonate of soda require nearly 15 per cent. of the same acid for their neutralisation.

It would, therefore, be sufficient to establish, by caculation, a Table in the following form for each hundredth, in order to be able, only after the employment of an alkalimetric test acid, to obtain immediately the indication in hundredths of the proportion of soda contained in potassa.

A anhydrous carbonate of potassa, 100 grains of which require, for their neutralisation, the following quantities of dilute sulphuric acid (of the specific gravity of 1·0687),	Contains the following numbers of hundredths of anhydrous carbonate of soda :—
1000	0
1025½	5
1051	10
1102	20
1127½	25
1255	50
1382	75
1510	100

Although such a Table may serve for determining with sufficient accuracy for the object in question, and very promptly, the proportion of soda which might be found in a pure carbonate of potassa, it is not, however, applicable to testing the various kinds of potassa of commerce, especially because all, even without being adulterated, contain different accidental mixtures, such as chloride of sodium, chloride of potassium, sulphate of potassa, silica, &c., and because, so long as we are unacquainted with the quantity of all these substances united, and have not subtracted them from the weight of the dry potassa, the preceding Table cannot be made use of with clearness; for, admitting that a potassa contains, for example, 80 per cent. of carbonate of potassa, 6·7 per cent. of accidental impurities, and 13·3 per cent. of anhydrous carbonate of soda, this potassa should, according to this Table, be regarded as pure and dry carbonate of potassa, for the 13·3 of anhydrous soda found in it would require for their neutralisation nearly as much alkalimetric test-acid as 20 of pure and dry carbonate of potassa.

But even when it is wished summarily to determine previously the quantity of accidental impurities of potassa, to subtract them from 100 grains of potassa, and to reduce to 100 the number obtained after the neutralisation, an accurate result cannot be arrived at, because we rarely find in commerce a potassa which contains only simple carbonate of potassa, without any mixture of free caustic potassa, or, which is most common, of sesquicarbonate of potassa, and in both these cases the numbers indicated in the Table would be inaccurate; for if a pure potassa, submitted to examination, contained free caustic potassa, we should, from the employment of the test-acid, maintain, according to the foregoing Table, that this potassa contained soda, whilst at another time we should declare to be free from adulteration a potassa containing much sesquicarbonate of potassa, and which would not be mixed with too great a quantity of soda. It is evident, therefore, that this Table would be applicable only after having first not only removed from the potassa submitted to examination all the foreign mixtures, with the exception of soda, but also after having transformed into simple carbonate the alkali obtained, if this were potassa alone, or mixed with soda; but, as this operation would be too difficult, and would require too much chemical skill, this mode of testing, to ascertain the proportion of soda contained in potassa, cannot be admitted, at least as an ordinary process.

The same observation is applicable to the case in which it is desired to calculate the proportion of soda contained in a potassa by the increase of weight which takes place when moistened potassa is exposed to an atmosphere of carbonic acid, until there is no further augmentation of weight, or by the loss of weight produced by the expulsion of carbonic acid by potassa by a more energetic acid; indeed, these two processes could be used only for operating on mixtures of pure simple carbonate of potassa with anhydrous simple carbonate of soda.

All these considerations show the difficulties which the solution of the problem entails.

I then asked myself whether it would not be possible to effect a separation by converting the alkaline carbonates of the potassa to be examined into bicarbonates, and then separating, by means of a solution of bicarbonate of soda, completely saturated at the ordinary temperature, the bicarbonate of soda formed from the bicarbonate of potassa; for, on one hand, a saturated solution of a salt cannot naturally dissolve more of the same salt at the same temperature, whilst, on the other hand, it might be expected that the solution of bicarbonate of soda would dissolve not only the bicarbonate of potassa, but also the accidental impurities of the potassa, such as the chloride of potassium, the chloride of sodium, the sulphate of potassa, &c., and would leave only the bicarbonate of soda

rising from the simple carbonate of soda contained in the potassa, and which would enable the quantity of this carbonate to be readily calculated.

In order to ascertain whether this idea was practically executable, I wished first to convince myself of the solubility of sulphate of potassa, chloride of potassium, and chloride of sodium (the ordinary impurities of potassa), as well as of bicarbonate of potassa in a solution of bicarbonate of soda: I weighed with this object four times 1,000 grains of a solution completely saturated at 54·5° F. of carbonate of soda, and I added to them these four salts by grains, until they were no longer dissolved. When the last grain added remained at the bottom of the vessel without being dissolved, after the liquor had been carefully stirred, and at a temperature of 54·5° F., I found that there was dissolved in 100 parts of the solution of bicarbonate of soda—

Bicarbonate of potassa...	245	grains
Sulphate of potassa.....	180	,,
Chloride of potassium....	285	,,
,, sodium.....	75	,,

After having determined these proportions, I endeavored to convert into bicarbonates, by carbonic acid, mixtures, expressly prepared, of soda moistened with a solution of bicarbonate of soda; but I found that not only was this object slowly attained, but that it could be only incompletely fulfilled in a simple manner. I could not saturate with carbonic acid a complete solution of these two mixtures in water, because it is necessary to drive off all the water of the solution in order to be able to separate from each other, by a concentrated solution of bicarbonate of soda, the crystallised salts obtained. I therefore tried, in order to avoid this inconvenience, to dissolve in a solution of bicarbonate of soda, saturated cold, new mixtures, (of 100 grains) expressly prepared, of soda and potassa: this operation likewise succeeded well, and nothing remained undissolved except the silica.

I then passed, for three days, a continued current of carbonic acid into these solutions thus prepared, of mixtures of potassa and soda, to which I also joined a simple solution of potassa in the concentrated solution of bicarbonate of soda.

The solution, which contained only potassa, presented, even at the end of several days' saturation by carbonic acid, no separation of bicarbonate of potassa or soda, and the liquor had not undergone (at least in appearance) the slightest change.

A solution which contained a mixture of 90 grains of potassa and 10 grains of anhydrous carbonate of soda, gave by a current of an excess of carbonate acid a crystalline precipitate of bicarbonate of soda, which, collected on a filter and pressed between folds of blotting paper, weighed, while damp, 19 grains; its weight was 14·6 grains after it had been completely dried at the ordinary temperature.

A filtered solution of 80 grains of potassa and 20 grains of anhydrous carbonate of soda, treated in the same manner, gave 22·7 grains of bicarbonate of soda, pressed and still moist, and 16·9 grains of the same salt dry. A solution of 70 grains of potassa and 30 grains of anhydrous carbonate of soda, gave 44·1 of humid bicarbonate of soda, and 36·7 of the same salt dry.

A solution of 60 grains of potassa and 40 grains of anhydrous carbonate of soda gave, by the same process, 59·1 of humid bicarbonate of soda, and 49·7 of the same salt dry.

Finally, a solution of 50 grains of potassa and 50 grains of anhydrous carbonate of soda, gave 72·2 of humid bicarbonate of soda, and 58·6 of the same salt dry.

If we examine this result a little nearer, we shall find that the quantities of bicarbonate of soda obtained are too small.

For the following quantities of simple carbonate of soda—	Should give the following quantities of crystallised bicarbonate:—
10	17·5
20	35
30	52·5
40	70·0
50	87·5
But they gave only—	**Deficiency:**
14·6	2·9
24·9	10·1
36·7	15·8
49·7	20·3
58·5	29·0

This too small produce is also increased by the impossibility of driving off all the liquid by means of the simple pressure of the bicarbonate of soda separated and collected on a filter, and it indeed suffered an increase of weight proportionate to the fixed principles contained in the quantity of the liquid which was not separated by pressure. Moreover, this difference would be insignificant, and it would be easy to calculate it by the weight of the bicarbonate of soda obtained in the humid and dry states, according to the known proportions of the concentrated solution of bicarbonate of soda, if there were not other obstacles. If, now, we seek for the reason why too little bicarbonate of soda was obtained, we find it in the extreme difficulty of converting into bicarbonates, by a current of carbonic acid, a mixture of soda and potassa dissolved in a solution of bicarbonate of

soda; for, at the end of three days' passing of carbonic acid into a solution of potassa, mixed with only a very small quantity of soda, the liquor had always an alkaline reaction, proves that all the alkaline carbonate had not been converted into bicarbonate: this circumstance renders this process, also, insufficient for the sure and prompt determination of the quantity of soda contained in the potassa, although it may always be used for an approximative determination, as the foregoing investigations manifestly show.

Moreover, as potassa (simple carbonate) cannot take water of crystallisation, whilst anhydrous soda (this is the state in which it is found in the potassa which it serves to adulterate), on the contrary, absorbs a very considerable quantity of it, in order to form crystals, it was natural to hope to determine, approximatively at least, the quantity of soda which might be found in the potassa, by estimating the proportion of water necessary for reducing a given quantity of potassa to a state of pappy mass; so that, even after a long time, it will not solidify any more; for it might be foreseen that there should be so much the more soda in the potassa, as more water is required to reduce the potassa to this state.

In order to carry out this idea practically, I prepared the following mixtures of pure simple carbonate of potassa, and anhydrous simple carbonate of soda:—

1.	90 gr.	potassa and	10 gr.	anhydrous soda.
2.	80	,,	20	,,
3.	70	,,	30	,,
4.	60	,,	40	,,
5.	50	,,	50	,,
6.	40	,,	60	,,
7.	30	,,	70	,,
8.	20	,,	80	,,
9.	10	,,	90	,,

I then added water by drops to these nine mixtures, until the state of each of them was such that they became no harder, and until they were slightly pasty, and susceptible of being kneaded. Notwithstanding the facility with which this point was attained, by an unfortunate circumstance this operation required a very long time proportionally, for this object was seldom effected in less than forty-eight hours. It is scarcely necessary to observe that, during this time, I prevented as much as possible the access of atmospheric air by covering the vessel, in order not to have false results, by the loss of water evaporating during that time. It was necessary also to take care not to leave the moistened mixtures too long without looking at them, because otherwise it often happens that the mixture hardens to such a degree that it is very troublesome to divide it properly.

After the moistened mixtures had ceased to become harder, when in a homogeneous state, and capable of being gently kneaded, I determined the quantity of water necessary for each mixture separately, and I found that the following quantities had been added:—

	Grains of Water.
To the first mixture	17
,, second	40
,, third.....	57
,, fourth	68
,, fifth	80
,, sixth.....	95
,, seventh....	107
,, eighth	118
,, ninth.....	130

It is evident that the result answered, and that the property of soda, of being able to absorb a very great quantity of water of crystallisation—a property which potassa does not possess—presents to us a means of determining, in an extremely simple manner, although only approximatively, the proportion of soda contained in potassa.

With respect to the accuracy of this process, it doubtless still leaves much to be desired; for I am convinced, from a great number of investigations, that it may yet give rise to an error of two or three per cent., even when we have become familiarised with its execution by considerable practice, and that it is a pure chance if the error remains less than a hundredth. Moreover, the impurities which are ordinarily found in potassa do not interfere much with its accuracy; these are ordinarily substances, such, for example, as the sulphate of potassa, chloride of sodium, chloride of potassium, silica, &c., which do not take up water of crystallisation, and the quantity of water necessary merely to moisten these ordinary impurities of potassa is so small, that it is not necessary to take account of it.

Moreover, it is necessary, in the examination of a sample of potassa by this process, to commence by freeing it from the water which it contains, by putting it in an oven, or any other warm place—or, better still, to heat it to redness, in order to convert into simple carbonates the sesquicarbonates which it may contain.

Although, according to these considerations, this process cannot be sufficient for the chemist, and should never be adopted as a basis in important cases, it may, however, very well serve the purpose of persons unacquainted with chemistry, (ordinary merchants and manufacturers,) on account of its great facility of execution.

Moreover, the circumstance already mentioned—that, on the one hand, this process cannot pretend to accuracy, and that, on the other hand, it requires a long time for its

execution, (which appears to be an inconvenience for ordinary use, which requires the utmost speed,)—this circumstance, I say, induced me to pursue this subject still further, and with this view I had recourse to tartaric acid.

I expected to find, in the property which bitartrate of potassa possesses, of dissolving only with considerable difficulty in water, the most convenient means for founding a process of testing potassa on the employment of this acid; for it must be foreseen, that if to a sample of potassa, containing soda, be added the proportion of tartaric acid precisely necessary for converting the two alkalis into bicarbonates, the bitartrate of soda, in presence of a sufficient quantity of the solvent, should remain in solution on account of its greater solubility, and the bitartrate of potassa should be precipitated, under the form of a crystalline powder, either in greater part or entirely, when all the liquors employed have been previously saturated with bitartrate of potassa at the ordinary temperature: this deposit might then easily be measured.

In order to make a trial of this theoretical supposition, it was necessary first to solve the following question—"*How much bitartrate of soda is dissolved in a solution of bitartrate of potassa, at the ordinary temperature?*"

In order to solve this question, I put into 240 grains of a solution of bitartrate of potassa, completely saturated at the ordinary temperature, crystallised bitartrate of soda, until the last portion added remained undissolved, after the mixture had been well stirred—13·6 grains of bitartrate of soda were dissolved. Consequently, 100 parts of concentrated solution of bitartrate of potassa dissolve 5·6 parts of bitartrate of soda, or, to dissolve 1 part of the latter salt, 17 8 parts of the saturated solution of the bitartrate of potassa are required. If, therefore, 100 grains, for example, of anhydrous carbonate of soda be converted into 358·1 of bitartrate of soda, by the necessary quantity of tartaric acid, 6,394 grains of solution of bitartrate of potassa, completely saturated, at the ordinary temperature, are required for holding in solution the bitartrate of soda formed.

This circumstance should furnish one of the bases for the process to be followed; for the other, it was necessary to find the space which would be occupied by the quantity of bitartrate of potassa which might be formed by 100 grains of perfectly pure simple carbonate of potassa.

In order to solve this question, after some preliminary investigations, of which it is useless to speak, I took a glass tube, of as equal a diameter as possible, and of equal thickness throughout—about three feet in length, and five lines in diameter—and I closed it at one of its extremities.

I then put into this tube a solution of bitartrate of potassa which had been prepared in the following manner:—I poured into a small glass matrass, capable of being corked, on one-fourth of the quantity of bitartrate of potassa, which 100 grains of pure carbonate of potassa can furnish, that is to say, on 68·2 grains about two ounces and a quarter of solution of bitartrate of potassa saturated at the ordinary temperature; I well corked it, and heated it cautiously, in order to effect the complete solution of the bitartrate of potassa.

The warm and perfectly clear solution was then promptly poured into the above-mentioned tube; the matrass was washed with a smaller quantity of solution of bitartrate of potassa, saturated cold: I well corked and agitated, until the temperature of the tube and its contents was completely reduced to that of the surrounding atmosphere, or rather to that of the solution of bitartrate of potassa, at the commencement of the experiment. I plunged the tube several times into cold water, in order to accelerate cooling.

The crystalline powder thus separated, whose quantity, as may readily be conceived, should correspond to 25 grains of potassa, was collected in the smallest possible space by striking the tube several times on a hard body, and when new blows did not heap it up, I made a mark with a file on the tube at the level obtained by the crystalline powder of bitartrate of potassa. The space below the mark was then divided into 25 equal parts; then I continued to graduate the tube towards the upper part, until I had marked 100 parts, and I added the numbers, ascending from 0 to 5, from the lower part towards the upper. I afterwards broke the tube at about two inches above the place marking 100, and I united with the lamp the acute angles.

This tube, thus prepared, was tried in several ways, until I was perfectly convinced that each part exactly answered to one grain of pure carbonate of potassa.

This tube then served as a standard instrument for testing a suspected sample of potassa: for this purpose, we proceed in the manner I am about to describe.

Two portions, of 100 grains each, of the potassa to be examined, are weighed out. The first 100 grains are tested by the ordinary process of alkalimetry; the quantity of test-acid employed in the Table, No. I., is ascertained, and the corresponding quantity of carbonate of potassa is noted; then the

second 100 grains are dissolved in 8 or 10 times their weight of the solution of bitartrate of potassa, completely saturated at the ordinary temperature, and of which a very large quantity should always be kept in reserve. The solution is filtered in a flask capable of containing about one pound of water, and the filter is washed with the saturated solution of bitartrate of potassa. Then a quantity of tartaric acid, in fine powder, is added, equal to that indicated by the adjoined Table, (No. II.,) that is to say, the quantity necessary to convert into bitartrate all the alkali which is found in the potassa (potassa or soda, or both at once, carbonated or caustic). This done, a sufficient quantity of the same solution of bitartrate of potassa at a known temperature is poured into the flask, so that its whole quantity may amount to about 6,400 grains. A slight excess or deficiency is generally without inconvenience. In order not to be obliged to weigh every time, the height obtained by the liquor may be marked with a file.

The flask is then corked, put in a warm place, and carefully stirred. It is not at all necessary that the bitartrate of potassa ready formed should then be completely dissolved, because it does not prevent the alkali from being converted into bitartrate, and changed into a fine crystalline powder; but in order that afterwards the precipitation of the powder of bitartrate of potassa may take place in a very uniform manner, and allow of as concordant a measuring as possible, it is better to heat and agitate the corked flask until the solution is complete; but, as I have already said, this care may be very well neglected, without fear of committing any essential error. The heated and still corked flask must be cooled as speedily as possible, by plunging it into water, or snow in winter, and stirring it briskly. It is as well, then, in order to obtain a crystalline powder of a very equal grain, to reduce the temperature of the flask and its contents below that of the surrounding atmosphere; but, in that case, it is necessary to restore their temperature to the same degree as that of the solution of bitartrate of potassa, saturated cold, before the experiment: this is easily done. The cork of the flask is then replaced by another, in which is securely fixed the open extremity of the measuring tube. However, it is necessary that neither the tube nor the cork descend into the neck of the flask more than is necessary, for the cork to be hermetically adapted to the sides of the neck, in order that, when the flask is inverted, it may not deposit crystalline powder between the cork and neck of the flask. The flask is then inverted, and, by shaking it, all the powder of bitartrate of potassa is made to fall into the tube; then the flask is withdrawn; it is then no longer necessary to take account of its contents for the test, (and the tube is struck on a solid body until the crystalline powder is collected into the smallest possible space,) and we may then, without any other operation, read on the scale the number of hundredths of pure carbonate of potassa contained in the potassa examined.

After having ascertained, in the manner described, the quantity of pure carbonate of potassa which is found in the potassa examined, we seek for the difference which exists between the parts of the test-acid employed in the alkalimeter, and the hundredths of carbonate of potassa found in the measuring tube, and this number sought in the Table (No. III.) then indicates, without any other calculation, the proportion of hundredths of soda with which the potassa examined was adulterated.

Let us suppose, for example, that 100 grains of a sample of potassa had employed for their neutralisation 60 degrees of test-acid, the quantity of carbonate of potassa which corresponds to them must be sought for in the Table, No. I. The number in question is 87·5. Now, if 100 grains of the same potassa gave likewise 87·5 of crystalline powder in the measuring tube, there would be no difference between the two numbers found, and it must be concluded that the potassa in question was not adulterated with soda.

If, in another experiment, the quantity of carbonate of potassa found by the alkalimeter was 52, and if my measuring tube indicated only 32, it would be necessary to subtract this latter number (which represents the hundredths of pure carbonate of potassa really contained in the potassa) from the first, namely, 52, and to seek the difference (20 in this case) in Table III., in order to find the number of hundredths of soda with which the potassa examined is adulterated: this would be 22·5 hundredths in the present case. The 25·5 hundredths which are still wanting should then be attributed to the ordinary and accidental impurities of potassa.

If a saline mass, sold for potassa, gave by the alkalimeter 80 degrees, and if there were not formed, on the contrary, any crystalline powder in the measuring tube, the salt in question would be only carbonate of soda, with 10 per cent. of other impurities; for the number found of alkalimetrical degrees would immediately indicate the difference sought for, since, in the latter case, there would be nothing to be subtracted.

We may here remark, in conclusion, that this process, which has fully satisfied me,

may also be simplified by using an alkalimeter with a solution of tartaric acid, saturated with bitartrate of potassa, instead of test-acid, and dividing the alkalimeter in such a manner, that each degree shall answer to one grain of pure carbonate of potassa; for, in this case, it is sufficient to neutralise the 100 grains of potassa submitted to examination, to note the quantity of test-acid employed; to add, also, an equal quantity of test-acid, as has been indicated above, and the difference between the carbonate of potassa, indicated by the alkalimeter and in the tube, will give, by aid of Table III., the measure of the adulteration.

TABLE I.

The following degrees of the Alkalimeter :—	Answer to the following quantities of Carbonate of Potassa.	The following degrees of the Alkalimeter :—	Answer to the following quantities of Carbonate of Potassa.
1 ..	1.45	46 ..	67·08
2 ..	2·91	47 ..	68·54
3 ..	4·37	48 ..	70·00
4 ..	5.83	49 ..	71·45
5 ..	7·39	50 ..	72·91
6 ..	8·74	51 ..	74·37
7 ..	10·20	52 ..	75·83
8 ..	11·66	53 ..	77·29
9 ..	13·12	54 ..	78·75
10 ..	14·58	55 ..	80·20
11 ..	16·04	56 ..	81·66
12 ..	17·50	57 ..	83·12
13 ..	18·95	58 ..	84·58
14 ..	20·41	59 ..	86·04
15 ..	21·87	60 ..	87·50
16 ..	23·33	61 ..	88·95
17 ..	24·79	62 ..	90·41
18 ..	26·24	63 ..	91·87
19 ..	27·70	64 ..	93·33
20 ..	29·16	65 ..	94·79
21 ..	30·62	66 ..	96·25
22 ..	32·08	67 ..	97 70
23 ..	33·54	68 ..	99·16
24 ..	35·00	69 ..	100·62
25 ..	36·45	70 ..	102·08
26 ..	37·91	71 ..	103·54
27 ..	39·37	72 ..	105·00
28 ..	40·83	73 ..	106·45
29 ..	42·29	74 ..	107·91
30 ..	43·75	75 ..	109·37
31 ..	45·20	76 ..	110·83
32 ..	46·66	77 ..	112·29
33 ..	48·12	78 ..	113·75
34 ..	49·58	79 ..	115·20
35 ..	51·04	80 ..	116·66
36 ..	52·50	81 ..	118·12
37 ..	53·95	82 ..	119·58
38 ..	55·41	83 ..	121·04
39 ..	56·87	84 ..	122·50
40 ..	58·33	85 ..	123·95
41 ..	59·79	86 ..	125·41
42 ..	61·25	87 ..	126·87
43 ..	62·70	88 ..	128·33
44 ..	64·16	89 ..	129·79
45 ..	65·62		

TABLE II.

To a Potassa which marks the following degrees of the Alkalimeter—	Must be added the following quantity of tartaric acid:—	To a Potassa which marks the following degrees of the Alkalimeter—	Must be added the following quantity of tartaric acid:—
1	3·19	46	147·07
2	6·39	47	150·27
3	9·59	48	153·47
4	12·78	49	150·67
5	15·98	50	159·86
6	19·18	51	163·06
7	22·38	52	166·26
8	25·57	53	169·46
9	28·77	54	172·65
10	31·97	55	175·85
11	35·17	56	179·05
12	38·36	57	182·25
13	41·56	58	185·44
14	44·76	59	188·64
15	47·96	60	191·84
16	51·15	61	195·03
17	54·35	62	198·23
18	57·55	63	201·43
19	60·75	64	204·63
20	63·94	65	207·83
21	67·44	66	211·02
22	70·34	67	214·22
23	73·53	68	217·42
24	76·73	69	220·61
25	79·93	70	223·81
26	83·13	71	227·01
27	86·32	72	230·21
28	89·52	73	233·40
29	92·72	74	236·60
30	95·92	75	239·80
31	99·11	76	243·00
32	102·31	77	246·19
33	105·51	78	249·39
34	108·71	79	252·59
35	111·90	80	255·79
36	115·10	81	258·98
37	118·30	82	262·18
38	121·50	83	265·38
39	124·69	84	268·57
40	127·89	85	271·77
41	131·09	86	274·97
42	134·28	87	278·17
43	137·48	88	281·36
44	140·68	89	284·56
45	143·38		

TABLE III.

If the difference is—	The Potassa tested is adulterated by the following quantities of Soda in hundredths.	If the difference is—	The Potassa tested is adulterated by the following quantities of Soda in hundredths.
1	1·125	46	51·75
2	2·25	47	52·87
3	3·37	48	54
4	4.50	49	55·12
5	5·6	50	56·25
6	6·75	51	57·37
7	7·87	52	58·5
8	9	53	59·62
9	10·12	54	60·75
10	11·25	55	61·87
11	12·375	56	63
12	13·50	57	64·12
13	14·62	58	65·25
14	15·75	59	66·37
15	16·87	60	67·5
16	18	61	68·62
17	19·12	62	69·75
18	20·25	63	70·87
19	21·37	64	72
20	22·50	65	73·12
21	23·62	66	74·25
22	24·75	67	75·37
23	25·87	68	76·50
24	27	69	77·62
25	28·125	70	78·75
26	29·25	71	79·87
27	30·37	72	81
28	31·5	73	82·12
29	32·62	74	83·25
30	33·75	75	84·37
31	34·87	76	85·50
32	36·0	77	86·62
33	37·125	78	87·75
34	38·25	79	88·87
35	39·37	80	90
36	40·50	81	91·12
37	41·62	82	92·25
38	42·75	83	93·37
39	43·87	84	94·50
40	45·12	85	95·62
41	46·12	86	96·75
42	47·25	87	97·87
43	48·37	88	99
44	49·50	89	101·12
45	50·62		

REPORT ON A MEMOIR OF M. JACQUELAIN, RELATIVE TO THE PRODUCTS OF THE RECIPROCAL ACTION OF ANHYDROUS SULPHURIC ACID AND AMMONIA.*

BY M. DUMAS.

The Academy having charged MM. Pelouze, Regnault, and myself with the examination of a memoir by M. Jacquelain, concerning the products of the reciprocal action of anhydrous sulphuric acid and ammonia, we now make our report.

M. Jacquelain's investigations relate to a class of phenomena to which Davy called the attention of chemists, and more recently submitted by H. Rose to an experimental examination, which furnish results of great interest.

Davy showed that the oxacids combine purely and simply with the oxygenous bases, so that KO and SO^3 give KO, SO^3. He also showed, that the hydrobases are united in the same way quite simply with the hydracids, in such a manner that NH^3 and HCh give hydrochlorate of ammonia NH^3 HCh. Doubtless these formulæ may be read in different manners; but they represent, in all hypotheses, all the elements of the acid and all those of the base, which in fact exist entire in the salts formed by these two kinds of reactions. But, if an hydracid be put in contact with an oxygenous base, quite different results are obtained—water and a metallic binary compound are formed and separate: KO and HCh give KCh and HO.

Finally, if oxygenous acids are made to react on hydrogenous bases, we almost always cause an elimination of water and a formation of a compound which is not a salt. In general, since the discovery of oxamide, we have been disposed to regard the products resulting from these reactions as analogous compounds, and to determine their formulæ in the same manner.

As regards sulphuric acid and ammonia, the investigations of M. Regnault have proved the existence of sulphamide, $N^2H^4SO^2$, analogous to oxamide $N^2H^4CO^2$.

Indeed, H. Rose, in causing ammonia to react on sulphuric acid, did not form sulphamide, but more complicated products, and of a difficult theory.

M. Jacquelain has just taken this question in hand, and he has made an important step in it, by the discovery of a well crystallised body, resulting from the direct action of anhydrous sulphuric acid on ammonia, and by that of a barytic compound, to which this body gives rise.

According to his analyses, the crystallised body contains $4\,SO^2 + 3\,N^2H^6$, and the barytic combination which is derived from it, $3\,SO^3 + 9\,BaO + N^2H^6$.

Certainly these are unforeseen formulæ, and demand profound study, in order to be interpreted. The first memoir of M. Jacquelain has for its object the accurate analysis of these bodies. We should encourage him to pursue this examination, with a view to the interpretation of the formulæ which he has found, and which requires an attentive comparison of their reactions.

* *Comptes Rendus*, No. 8, Feb. 19, 1844.

ON THE LAWS WHICH GOVERN THE ELECTRO-CHEMICAL DECOMPOSITION OF BODIES.*

BY M. EDMUND BECQUEREL.

The object which I have proposed to myself, in the work which I have the honor of submitting to the Academy, is to make known the laws which govern the electro-chemical decomposition of bodies.

Faraday had laid it down as a principle, that when the same current was made to traverse several metallic solutions, such as those of nitrate of copper, lead, silver, &c., equivalent quantities of the metal are deposited at the negative pole in each solution. But this law is true in only very few cases, when its salt is formed of one equivalent of oxide and one equivalent of acid, and does not account for the effects observed in the decomposition of a very great number of combinations.

I will mention, as an example, the hyponitrites of lead, which give, at the negative pole, twice and three times and a half as much lead as the nitrate, with the same current.

I have examined the decomposing action of electricity on series of well analysed bodies: thus I have successively submitted to experiment all the metallic chlorides, the oxides and oxygenised water, the acetates and hyponitrites of lead, &c.

All the results which I have obtained, have led me to the following conclusions:—

When a binary or ternary compound is submitted to the decomposing action of electricity, the decomposition always takes place in definite proportions, so that, for one equivalent of electricity employed, an equivalent of the electro-negative element, or at least of the compound which acts the part of an acid in the combination, is carried to the positive pole, and the corresponding quantity of the electro-positive element, or that which acts as base, is carried to the negative pole.

* *Comptes Rendus*, No. 10, March 4, 1844.

The law may be set forth as follows:—

One equivalent of a combination formed by the union of an equivalent of acid, and a corresponding quantity of base, always requires an equivalent of electricity in order to be electro-chemically decomposed.

I have called *equivalent of electricity* the quantity of electricity necessary for decomposing an equivalent of water.

These laws relate only to the direct effect of the current, and not to the secondary effects; for there exist certain salts, such as the acetates of lead, which are decomposed only by the reductive action of the hydrogen arising from the decomposition of water, and which always give an equivalent of metal at the negative pole.

If an equivalent of electricity be required for decomposing an equivalent of any combination whatever, it may be admitted that if the two elements—electro-positive and electro-negative—which form the combination, are separated and re-combined, they disengage exactly an equivalent of electricity. Hence, with regard to law enunciated above, the following conclusions are deduced, which are *very important in molecular chemistry*:—

1. When an equivalent of a body, either simple or compound, is combined with one or more equivalents of another body, if the first acts the part of an acid in the combination, the disengagement of electricity which results from their chemical action is such that it always produces an equivalent of electricity.

2. If an equivalent of a body, such as oxygen, is already combined with another which acts the part of a base, and if the composition again unites with an equivalent of the first body, that is to say with oxygen, in order to form a deuto-salt, there is again disengaged, in this second action, an equivalent of electricity. Thus the quantity of electricity disengaged depends only on the body which acts the part of acid in the combination.

In my memoir, inorganic substances alone have been alluded to, because organic substances are, for the most part, non-conductors of electricity, and because, when they do conduct, the secondary effects so disguise the direct effect, that it is very difficult to recognise the definite action of electricity.

The principles which I have laid down represent well all the results obtained as regards the direct effects, so that there exists a constant relation between the chemical theory of equivalents and the decompositions by electricity: it was very important to establish them, for they should serve as a starting point for every electro-chemical theory.

EXTRACT OF THE REPORT OF THE FIRST CLASS OF THE ROYAL INSTITUTE OF THE NETHERLANDS, ON THE NUTRITIVE QUALITIES OF GELATINE: PRESENTED TO HIS EXCELLENCY THE MINISTER OF THE INTERIOR.*

Your Excellency having invited the Institute, in your letter dated June 28, 1842, to present to you a report on the question,—Can gelatine be regarded as an useful and agreeable aliment for man?—the first class charged its members, MM. Vrolik, S. Swart, and J. G. S. Van Breda, with furnishing it with facts which might enable it to comply with your Excellency's desire. In giving the summary of their labors, the class has the honor of fulfilling the task which was imposed upon it.

It is known that the results obtained by the members named by the Academy of Sciences of Paris were so unfavorable to the nutritive qualities of gelatine, that it was justly concluded that, taken separately, it is not nutritious. But these *savants* did not decide whether, by adding it to other alimentary substances, the nutritive power of the latter is not increased by affording a good vehicle to the elements of which they are composed. Professor Bergsma, whose memoir appears to have given rise to the letter of your Excellency, considered that gelatine really has this property, and the first class of the Institute has been called upon to verify the basis on which this favorable opinion is founded. It has conceived that positive facts alone could solve this question, and, consequently, it authorised the Commissioners to make, at the expense of the Institute, all the experiments which might serve for elucidating this still doubtful point. The summary of their labors will demonstrate to your Excellency that they have not thought it necessary to repeat all the experiments made with so much care by the French Academicians. It is sufficiently proved by these experiments, and by those previously made by M. Magendie, that neither the non-nitrogenous organic principles, nor those which contain nitrogen, can furnish a good aliment if taken singly, without being mixed with other substances. It is much more interesting to determine whether gelatine, which is a nitrogenous organic principle, although incapable of itself of affording nourishment to man, may, mixed with other aliments, increase their nutritive power, and thence become an useful and desirable addition to them. The

* *Comptes Rendus*, No. 11, March 11, 1844.

Academy of Sciences of Paris left this question undecided, after having been occupied with these investigations for ten years; consequently, the Institute of the Netherlands is charged with the honorable task of solving it as far as possible. After a few preliminary preparations, the Commissioners made, from the 9th of Dec., 1842, to the 15th of June, 1843, a series of experiments which appear not uninteresting.

Gelatine extracted from bones was used, according to the manner proposed by M. Bergsma, by means of an apparatus, the model of which was given by M. Darcet, and which M. Bergsma has been kind enough to lend to the Class. The bones had already been used in culinary operations, and, consequently, were quite free from soft parts. Broken in small fragments, they were exposed for several days, and each day for seven or eight hours, to the action of steam. Care was taken, as often as the bones had been subjected to the steam for two hours, or two hours and a half, to collect the gelatinous water, and to evaporate it, in a tin vessel, to the consistence required for it to coagulate, by cooling, into the form of a jelly.

When the experiments required a greater quantity of gelatine than could be furnished by the apparatus, a tinned Papin's digester was used, capable of sustaining a slight pressure of steam. The latter furnished, when heat was properly applied, a gelatine which did not differ in appearance from that produced by the apparatus, provided that care were taken not to exhaust the bones too much, and that the inorganic matter were not mixed with the gelatine

The apparent characters of gelatine produced in these two ways are:—1st, an insipid taste, which, even when the gelatine is still quite fresh, is not very agreeable, and is not much improved by the addition of salt: 2nd, an analogous odor, not very strong, augmenting during the evaporation of the gelatinous water, and which cannot but be regarded as disagreeable: 3rd, a semi-pellucid consistence, with a strong tendency to putrefy. The evaporation of a small quantity, of 20 grains, for example, enabled the proportion of dry and solid gelatinous substance to be appreciated. This was done either by the sand-bath or by the heat of a stove. As the results of these two modes of acting were the same, the stove alone was afterwards used. The proportion of dry gelatine was, during the first weeks, about $\frac{10}{100}$, sometimes more, sometimes less. Afterwards, a little more consistence was given to the gelatine, so that the proportion of the solid substance varied from $\frac{10}{100}$ to $\frac{20}{100}$; and so that $\frac{15}{100}$ might be taken as an average.

Dogs were fed with this gelatine, which was given to them pure and fresh, in a well-lighted and aired enclosure, which was kept locked, and which the directors of the Zoological Garden of Amsterdam had placed at the disposal of the Class. Care was taken to allow none but the gentlemen constituting the commission and the keeper to have access to the dogs. In the first place, as a means of comparison, an experiment was made with three dogs, one of which received 0·250 of gelatine of bones, the second 0·125 of ordinary rye bread, and the third 0·125 of bread, with 0·125 of bone gelatine. The subjoined Table will give a better idea of all these details, and will show that, after a week, the dog which had been at first fed with 0·250 of gelatine, and, after its voluntary fast of two days, with 0·125 of gelatine and 0·125 of bread, had lost 0·75 of its weight; that the second dog, to which 0·125 of bread had been given, had lost 1 kil.; and that the third dog, which, from the commencement, had been fed with 0·125 of bread with 0·125 of gelatine, had also lost 0·75. This result proves, that the dogs to which 0·125 of bread with gelatine had been given, lost almost as much weight as that which had been fed with 0·125 of bread.

FIRST DOG.

Dates. 1842.	Nourishment.	Weight.	Observations.
Dec. 9.....	Gelatine 0·250	6·75	
10.....	*Idem.*	,,	
11.....	*Idem.*	,, ...	He has left his gelatine of the preceding day.
12.....	*Idem.*	,, ...	He has not touched the gelatine.
13.....	Bread.. 0·125.....	,, ...	0·125 of bread was added to the gelatine.
14.	Gelatine 0·125 Bread.. 0·125	6·00 ..	He ate the bread and left the gelatine, the quantity of which was undiminished.
15.....	*Idem.*	,,	
16.....	*Idem.*	,,	

SECOND DOG.

Dates. 1842.	Nourishment.	Weight.
Dec. 9 to 16. ..	Bread.. 0·125	9·25
,, ..	*Idem.*	8·25

THIRD DOG.

Dec. 9 to 16. ..	Gelatine 0·125	8·00
,, ..	Bread.. 0·125	7·25

But as this diminution in weight might be attributed to too great parsimony in the distribution of gelatine, the Commissioners resolved to repeat the same experiment with 0·187 instead of 0·125 as the daily ration.

Consequently, the first dog received 0·125 of bread, with 0·187 of gelatine.

The second dog, 0·125 of bread.

The third dog, 0·125 of bread, with 0·187 of gelatine. But after two days, it was judged that this quantity of gelatine should be raised to 0·250.

The result, after eight days, was, the first dog retained its weight, and that the others had each lost 0·50.

Thus, it is proved that the third dog, to which had been given first 0·187, and then 0·250 of gelatine, in the whole 0·125, lost quite as much of its weight as the second dog, whose ration consisted of only 0·125 of bread. It seemed, therefore, that the addition of this gelatine had not augmented the nourishing faculty of rye bread. But as it was possible that this result might be modified by a large employment of gelatine, the same experiment was continued.

The result is found in the following Table:

	Dates.	Nourishment.	Weight.
1st Dog	December 24	Bread.. 0·125 Gelatine 0·250	6·00
	,, 31	*Idem.*	5·50
2nd Dog	December 24	Bread.. 0·125	7·75
	,, 31	*Idem.*	7·75
3rd Dog	December 24	Bread.. 0·125 Gelatine 0·250	6·75
	,, 31	*Idem.*	6·50

Consequently, the dogs which had received 0·250 of gelatine with 0·125 of bread, showed each, after 8 days, a diminution of weight, whilst the weight of the dog to which only 0·125 of bread had been given, had undergone no change. Being struck with this unexpected result, the Commissioners continued the same experiment for 8 days longer :—

	Dates.	Nourishment.	Weight.
1st Dog	December 31	Bread.. 0·125 Gelatine 0·250	5·50
	January 7	*Idem.*	
2nd Dog	December 31	Bread.. 0·125	7·75
	January 7	*Idem.*	6·75
3rd Dog	December 31	Bread.. 0·125 Gelatine 0·250	6·50
	January 7	*Idem.*	6·00

Then the dogs gradually diminished in weight, nearly all in the same proportion, in the ratio of their primitive weight, as the subjoined Table shows :—

	1st Dog.	2nd Dog.	3rd Dog.
Primitive weight.....	6·75	9·25	8·00
Diminution of weight. 1st week	0·75	1·00	0·75
2nd ,,	0·00	0·50	0·50
3rd ,,	0·50	0·00	0·25
4th ,,	0·50	1·00	0·50
Consequently, in four weeks	1·75	2 50	2·00
Relative diminution	0·259	0·270	0·250

The general aspect of the dogs indicated that they did not receive sufficient nourishment. It was, consequently, necessary to re-establish their strength, and the ordinary ration of the dogs of the Zoological Gardens was distributed to them for 8 days, consisting of a mixture of greaves, bran, and boiled potato-parings. Experience showed that the dogs throve very well on this nourishment. After a week, each dog had gained 1 kilogramme in weight. Then they returned to the gelatine, increasing the quantity, however, giving on the first day 0·375, and the following days 500. After a week the result was :—

	Dates.	Nourishment.	Weight.
	January 13.....	Bread.. 0·125 / Gelatine 0·375	6·75
1st Dog.....	,, 14 to 20.....	Bread.. 0·125 / Gelatine 0·500	,,
	,, 20.....	*Idem.*	5·50
2nd Dog	January 13.....	Bread.. 0·125	7·75
	,, 13 to 20.....	*Idem.*	,,
	,, 20.....	*Idem.*	6·75
	January 13.....	Bread.. 0·125 / Gelatine 0·375	7·00
3rd Dog.....	,, 14 to 20.....	Bread.. 0·125 / Gelatine 0·500	,,
	" 20.....	*Idem.*	6·00

This remarkable result teaches us that, in this week, each dog lost 1 kilogramme of its weight; that the daily addition, first of 0·375, and then of 0·500 of gelatine, produced no difference; and that, consequently, this diminution occurred as well with those which had bread and gelatine, as with that one which had been fed with 0·125 of bread.

(*To be concluded in our next.*)

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

THE OPERATION OF EXCISE RESTRICTIONS UPON THE PROGRESS OF CHEMICAL SCIENCE, AS APPLIED TO THE ARTS AND MANUFACTURES OF THIS COUNTRY.

LETTER IV.

To the Editors of The Chemist.

GENTLEMEN,—

THE past and present states of calico printing offer most striking evidence of the injurious operation of the Excise laws upon a trade requiring, perhaps more than any other, a perfect knowledge of chemistry.

Every one, when speaking of the Excise laws, acknowledges their oppressive character. They are considered generally as bad fiscal regulations, required for the purposes of the Revenue; but I wish to impress on the minds of your readers, not so much the impolicy of these laws politically or commercially, as their unscientific character, and the deep injury they inflict on all those who look to the pursuit of chemistry as a profession. I have shown the progress of the manufacture of candles since the repeal of the duty—an advance dependent entirely on the application of practical and theoretical chemical knowledge to the treatment of tallow; and all interested in the trade are aware that no one can now enter into the manufacture of stearine candles without having had a chemical education, or employing a superintendent who has.

Now, the perfection of calico printing depends—first, on the mechanical skill with which the pattern is impressed on the cloth; and, secondly and mainly, on the manufacture of the colors, and the preparation of the cloth to receive them.

To succeed in these operations, great chemical knowledge and experience is required. No "rule of thumb" will do here.

The infinite variety of tints and colors—the mode of alternately printing and discharging portions of them—require great study thoroughly to understand. And how vast has been the improvement in design, in

color, in the neatness of execution, since the repeal of the duty, when the manufacturer was relieved from the *surveillance* of the excise-man! These improvements have enabled us to overcome, or very nearly so, the advantages which it was supposed the clear atmosphere and brilliant sun of the south of Europe conferred upon our foreign rivals. By them, our trade has enormously increased—the employment of thousands has resulted therefrom, and a number of plodding manufacturers, whose energies were cowed whilst they were watched and annoyed by the Excise, have become remarkable for their enterprise and intelligence, and each now reaps the reward arising from the application of knowledge, gained by close attention to his business and the study of the wonderful phenomena which chemistry has exposed to his view; and why, let us ask, should not the manufacture of colored glass, in imitation of the beautiful and now unfortunately rare German glass, advance in the same degree?

Circumstances have just occurred, in connexion with calico-printing and the Excise laws, too pertinent to my subject to be omitted.

All your readers are aware that alkalis and ammonia are extensively used in the various processes of dyeing and printing. Large quantities of soap are also used by printers in the preparation of their cloths. This soap could only be obtained in a given state: the Excise laws require that it should be made and sold under given regulations. If any thing but the usual soap-making materials are mixed with it, the manufacturer is charged with an extra duty of 20 per cent.: it must be sold in bars, and solid; liquid soap cannot be legally sold.

Now, it appears that it is necessary to the production of certain colors, that the soap used in the preparation of the cloth should contain sometimes an excessive and sometimes a small quantity of alkali, and that ammonia should be occasionally incorporated with it; but no such articles could be supplied by the licensed soap-maker. The printers, therefore, were in the dilemma of either losing the sale of certain cloths, or finding a new source of supply for their soap. It is clear soap of any kind can be made in the boilers of a print-work, but to do so would expose the plant-machinery to seizure for Excise duties. The print manufacturers could not enter themselves as soap-makers, for then they must make the soap according to law, with the same restrictions as the soap-makers.

The object to be attained, however, was of too great importance to be frustrated by the Excise laws, and, after much discussion, the printers have been allowed, by a Treasury order, to manufacture their saponaceous compounds free of duty, and free from the vexatious annoyances of Excise interference. So that the soap-maker, who pays for his license to make soap, is strictly surveyed and hampered by all sorts of vexatious regulations—is obliged to look on and see those who were his best customers make, in imperfect apparatus, that which he could profitably supply, were he but allowed to do so.

We appeal confidently to your readers, and ask—Can the injustice and absurdity of fiscal legislation go further?

Soap-makers *must* make soap according to law; but calico printers, their best customers, whom the law protects, cannot use it when so made.

To remedy an evil, great injustice is perpetrated; to encourage one trade, another is to be injured; to maintain the Excise law and its patronage, improvements are to be checked, science discouraged, trade deprived of its legitimate profits, and the intelligent and industrious manufacturer baulked by constant collision with fraudulent traders on the one hand, and the restraint which the presence of strangers on his premises—especially such strangers as excisemen—inevitably imposes upon him.

Whilst, therefore, chemistry is working wonders wherever its application is unrestrained, it produces no results in the manufactures under the Excise—glass, paper, and soap; these remain as they were of old—no new apparatus or processes. Need more be said on the subject? Let your readers, so deeply interested in the removal of these fiscal regulations, exert themselves, whenever opportunities occur, to promote their abolition; and at all times let them enforce on the minds of those who have the power to remove them, the absolute necessity of expunging these laws—relics of the worst period of our commercial history—from the statute book.

Thanking you, Gentlemen, for the space you have allowed me,

I am, your obedient servant,

H.

ON THE COLORATION OF METALS.

BY M. BECQUEREL.*

SECOND MEMOIR.

Preliminaries.

SINCE the two communications which I have had the honor of making to the Academy, touching the coloration of metals by means of successive deposits of peroxide of lead,

* *Comptes Rendus*, No. 6. February 5, 1844.

operated by the aid of voltaic electricity, I have multiplied the experiments, with the view of arriving at the causes of the effects produced, and of finding the most simple and, at the same time, most practical processes, by means of which uniform and durable tints may be obtaincd on objects of various forms of any metal, in order that industry may, without difficulty, be devoted to this new art. The results at which I have arrived, and which are given in the memoir, which I now have the honor of presenting to the Academy, attain (at least I hope so) the object which I have proposed; for I have not omitted any of the practical details calculated to enlighten industry, and to enable it to ensure the success of its operations.

The phenomenon of electro-chemical coloration, produced on metallic surfaces, is the same as that of the fine layers covering the surfaces of certain bodies, and showing by their transparency these same surfaces with colors whose nature and brilliancy depend on the nature and thickness of the deposited layers, of the color of the body, and which often present to our eyes the brilliant phenomenon of colored rings.

Nobili was the first who made known the production of colored rings, on plates of metal, by means of deposits produced by voltaic electricity—phenomena analogous to those formerly obtained by Priestley with successive discharges from electrical batteries. The English philosopher observed that, by transmitting these discharges several times, from a metallic point, on a plate of metal, several series of colored rings were formed on the latter, which were the same, whatever was the direction of the discharge, that is to say, the positive electricity, set out from the point, or from the layer: it must be concluded that the coloration depended on a cause acting equally on both sides. The experiments having at first been made on copper and steel—metals which color in cooling, after having been exposed to the action of a heat as strong as that which is disengaged during the discharge,—it might be thought that such was the cause of the production of the colored rings; but, as they were afterwards likewise obtained on platinum and gold, it was necessary to admit the transport of the same matter from the point, which in being deposited on the plate, in layers so much the finer, as they were at a greater distance from the central point, gave rise to colored rings—a conjecture which has been changed into certainty since the experiments of Fusinieri on the transmission of the matter through metallic substances, by the effect of discharges, whatever was the direction of these latter.

In order to form a very clear idea of the phenomena first described by Priestley, and afterwards studied, with great developments, by Nobili, who made use of voltaic electricity, and to compare them with those treated of in this memoir, I will detail the principal results obtained by these two philosophers.

When the metallic plate is submitted to the action of several discharges from an electrical battcry, by means of a point likewise of metal, thc color of the plate, at a considerable distance round the central spot, is changed, and the entire space is covered with a ccrtain number of concentric rings, each of which prescnts the beautiful colors of the spectrum. The nearer the point is to the plate, the sooner do the colors appear, and the more fixed are they; if the distance is exceedingly small, the colors appear at the first discharge, but they are then confused.

The number of rings increases in proportion to the fineness of the point; the more blunt it is, the broader and less numerous are the rings. On a steel plate, for a given distance, the colors are not immediately manifested around the central spot: a dark red zone is first observed, then, after four or five discharges, by looking obliquely at the surface, a circular space, either slightly shaded, or tinged with an extremely faint red color, is observed, which is gradually filled with rings of all colors, and whose borders become brownish if the discharges are continued beyond the first annular space, which was originally defined by a slight shade, and which is the first tint of the paler colors which are developed round the brownish red of which the interior surface is composed. The most decided tints are first developed round the central spot, and recede in proportion as the explosions are multiplied, in order to give place to new colors after thirty or forty discharges. There are three very distinct rings. By continuing, the colored circles become less beautiful and less clear, because the red predominates, and more or less tarnishes the other colors.

The deposited rings adhere so firmly, that a feather, or even the moistened finger, does not alter them at all; nevertheless, they may be removed with the nail. The interior rings present the greatest resistance: however, *they cannot resist slight rubbing.*

When the discharges are too energetic, and when steel is operated on, the surface is corroded, and erosions result whichimpair the clearness of the effects produced. These erosions do not take place on polished silver, tin, and bronze. Colored rings, as well as the above-described accompanying effects, are produced on gold, silvcr, copper, bronze, iron, lead and tin, and always, whatever may be the direction of the current.

In order to obtain colored rings by means of voltaic electricity, it is necessary, as Nobili first did, to concentrate the current, proceeding from one of the poles of the battery in a platinum wire, only the point of which dips into the liquid to be decomposed, whilst the other pole is connected with a metallic plate contained in the same liquid. This plate is placed perpendicularly to the direction of the wire, and at about one millimetre from the point. The effects produced depend on the nature of the metallic plate, on its positive or negative state, and on the nature of the solution. They are easily obtained in a few seconds with a battery of the ordinary form.

Nobili, by experimenting on a great number of solutions, with a platinum wire and plates of platinum, gold, silver, tin, bismuth, copper, brass, &c., obtained the various results, the chief of which I now detail.

SOLUTION OF SULPHATE OF COPPER.

Positive plate of silver.—Four or five concentric circles, alternately light and dark.

Negative plate of silver.—Three small concentric circles: the largest and the smallest of a deep red, the intermediate circle of a lighter tint.

Positive plate of brass.—Slight traces of fine concentric circles of the color of brass, some lighter, others darker, and thus alternating with each other.

Negative plate of brass.—Circles of two shades of metallic copper, alternating as on the silver.

SOLUTION OF SULPHATE OF ZINC.

Positive plate of silver.—A dark spot in the centre, a light yellow circle, then a circle of a light blue, and, finally, a beautiful zone verging on yellow.

Positive plate of brass.—Five small circles arising from metallic copper liberated by the action of the current, and presenting two alternate tints, one light, the other dull.

SOLUTION OF SULPHATE OF MANGANESE.

Positive plate of silver.—Five concentric circles, alternately light and deep, the fifth more distinct than the others, and surrounded by a halo of a pale yellow, which merges into a violet tint. These circles are analogous to those obtained with sulphate of copper.

SOLUTION OF ACETATE OF LEAD.

Positive plates of gold and platinum.—Concentric iris, composed of rings, emanating one from another, and propagating in the manner of waves.

Positive plate of silver.—A less distinct iris than on gold and platinum.

SOLUTION OF ACETATE OF COPPER.

Positive plates of platinum, gold, and silver.—Nothing remarkable.

The same plates negative.—With silver, for example, frequently four concentric circles, which, exposed to the air, take the following tints:—Deep blue in the centre, then yellowish red, lighter blue and yellowish red, presenting a different shade from the second tint.

SOLUTION OF ACETATE OF POTASSA.

Positive plate of silver.—A circle within three others, of one centimetre in diameter, surrounded with a very brilliant silver belt, to which succeeds a faint halo of various colors.

Analogous results were obtained by Nobili with many other solutions, and especially from liquids extracted from organic bodies, such as the juices of carrot, onion, parsley, horse-radish, cabbage, leaves of celery, and beet-root. The effects obtained with these liquids are so curious, that I will quote some of them.

JUICE OF CARROT.

Positive plate of silver.—Dark centre surrounded by two circles, one yellowish, the other greenish, then various zones of a deep color.

JUICE OF HORSE-RADISH.

Positive silver.—At the centre a dark point, surrounded by a small white circle; a greenish zone, terminated by a blue circle; then one or two circles of a fine golden yellow; and, finally, some very faint colored rings.

JUICE OF BEET-ROOT.

Positive silver.—At the centre, a red point surrounded by four circles, the first yellow, the second blue, the third red, and the fourth green; further on, two or three beautifully colored rings.

Nobili has drawn from his experiments the following conclusions:—

I. *There exists a difference between the mode of action of the two poles, with respect to the faculty which they possess of being covered with matters*, the positive pole, being far superior to the negative pole especially with respect to organic matter.

II. In general, the effect of the negative pole is increased by operating with a more intense current, or else by adding to the metallic salts a salt with an alkaline base.

The same philosopher thought that the effects of coloration which he obtained might be due to the deposits of fine films; but he has given no account of the nature of these deposits. For example, in relating what occurs with the mixture of the two acetates of copper and lead, he adds (*Annales de Chimie et de Physique*, 2nd Series, tom. xxxiv., p. 287):—

"But if the colored rings arise, as might be the case, from some one of the electro-negative substances of the solution deposited in fine films on the surface of these two metals, why should not this occur with other metals? This, perhaps, is a question worthy of exercising the sagacity of chemists."

Such are the results obtained, on one hand by Priestley, and on the other hand by Nobili, in their experiments on the production of colored rings by means of electricity, and which I have thought it right to relate, in order to make known the state of the question concerning the coloration, when I took it up in a different point of view from these philosophers. I will return to these results after having explained those which form the subject of this memoir.

In order to color metals according to the method indicated in my first memoir, and described in greater detail in the *Elements d'Electro-chimie*, which I have lately published, I employ an alkaline solution of lead, in which the oxide acts the part of the electro-negative element. I will recapitulate, in a few words, the mode of experimenting:—The solution is put into a glass vessel, containing a porous tube filled with nitric acid; the object to be colored is immersed in the solution, and a platinum plate in the acid; the object is to be put in connection of the positive pole of a decomposing apparatus composed of several elements, and the plate of platinum with the negative pole; the porous tube and the nitric acid may be dispensed with, and this is an easier plan, and the plate of platinum may be steeped in the alkaline solution. As soon as the communication is established, the surface of the object is covered with successive fine layers of peroxide of lead, which produce effects of coloration. The adherence of these layers is as great as that of gold or copper in gilding, because the protoxide of lead, which passes to the state of peroxide, by the action of the oxygen of the water, and the gold, are respectively set at liberty at the pole, which agrees with the part which each of these bodies performs in the solution. The deposit of peroxide may, therefore, be effected as regularly on the positive surface as that of gold on the negative surface, when all the conditions which will be given in this memoir are fulfilled. I will commence with the solution of plumbate of potassa.

COMPOSITION OF THE LIQUOR.

The alkaline solution should be completely saturated with oxide of lead, without which the deposited films of peroxide will be dissolved in the alkali, as soon as the current ceases to circulate, or even when there is only a relaxation in its chemical action. It is, therefore, necessary, when it has been used, to boil it occasionally, with an excess of litharge, in a flask, and, as much as possible, out of contact with the air, in order to prevent the potassa from absorbing carbonic acid. When it has been used for a long time, and contains, consequently, carbonate of potassa, it must be boiled with caustic lime, the carbonate of lime formed must be allowed to deposit, and filtered if necessary, or else the clear portion of the solution may be decanted into a vessel of convenient form. This solution should mark from 24° to 25° Beaumé; for experiment has proved that this density is most convenient for obtaining the best effects. When not being used, it is put into a flask, and carefully corked.

The temperature of the liquor should be that of the surrounding atmosphere; that is to say, from 54° to 60° F.

The success of the operation depends on the good composition of the liquor, on its density, on its temperature, and, moreover, as we shall show further on, on the intensity of the current, and on the perfect cleaning of the objects. This operation is as essential for the coloration of metals as for the electro-chemical gilding by immersion. The presence of fatty matters and other nonconducting substances on metallic surfaces, renders this perfect cleaning necessary.

PREPARATION OF THE SURFACES.

I have already said that the layers of peroxide of lead, being transparent, show the surface of the objects; consequently, as is the surface of these objects so is their appearance, or, rather, so is the brilliancy of the colors. Consequently, it is necessary, previously, to give them the proper state—that is to say, the burnish or the dead, according as brilliant or dead colors are required. Suppose we operate on polished plates of gold, gilded copper, or platinum, we commence by rubbing them with a soft brush and slightly alkalised water, and wash in a large quantity of water. When the adherence of foreign matters is too powerful for them to be removed by this means, the plates are rubbed with a brush covered with English rouge, then with a brush and alkalised water, and washed in a large quantity of water. It is then seen, that the pieces which were inactive at first are easily covered with richer colors. These various preparations are especially necessary when, after having removed the colors, the pieces are again experimented on; for there often remain deposits which destroy the lustre of the colors, or even prevent all further deposition. The pieces being prepared, it is necessary to avoid touching them with the

fingers, for their mark is indicated by the absence of the deposit, or simply a deposit of bad effect. The greatest precaution must therefore be taken to attach the conducting wires; it is also necessary to hold the objects with a cloth which has not touched any organic matter capable of adhering to the surfaces. On a good preparation, I repeat, depends the success of the operation.

It is necessary to act differently with copper, iron, and oxidisable metals, which, on account of their oxidation, are not always adapted for receiving such beautiful and varied colors as gold, gilt copper, and platinum.

With regard to copper objects, they must be made to undergo a first cleaning, by heating the pieces to redness, and immediately plunging them into dilute sulphuric acid, marking 12° of the areometer, whose temperature is 140° to 176°F. Pickling is then commenced by steeping them first in nitric acid, then in a mixture of nitric and sulphuric acids, in the proportion of three parts of the former to one of the latter, with a little common salt. Soot must be avoided, as it might deposit fatty matters. It is washed with a great quantity of water and immediately plunged into the alkaline bath, without being dried by sawdust—an operation which would not be without inconvenience, on account of the foreign bodies which would be deposited on the surfaces. The articles, after being cleaned, may indeed remain a short time in the water, out of the influence of the air, but, nevertheless, they must not be left too long, for fear of alteration.

When the copper has been cleaned with what is called the scratch-brush, very satisfactory effects of coloration are obtained, but which do not, however, approach those which the burnish and polish give, especially the former, which gives a vigor of tone not to be obtained with pickling; but, in this case, the very operation of polishing or burnishing leaves on the surfaces foreign bodies from which they must be freed, by washing as above, not with a brush and an aqueous solution of potassa, but with a very fine cloth steeped in alcohol holding in solution a small quantity of potassa, then washed in a large quantity of water. When the articles of copper and brass, especially the latter, are of but small dimensions (about two or three centimetres in surface), the coloration follows the same phases as on gilt surfaces of small or large extent; but when the dimensions are considerable, the surface remains brilliant for a longer or shorter time, and seems to be in a passive state, like that of iron which has been steeped in concentrated nitric acid; in this case, there is no effect of coloration. Whence, then, arises this passive state of brass, put in connexion with the positive pole of a voltaic apparatus? Is it due either to the formation of an oxide of copper, which is opposed, consequently, to that of the anhydrous peroxide, or to the simple decomposition of the plumbate of potassa? These are questions which it is our duty to point out in speaking of the state of the surfaces, but which can be investigated only when I speak of coloration. There is a certain sign by which we are enabled easily to ascertain that the deposit will not be produced, that is to say, when much lead is deposited on the negative electrode, and which is easily explained—the protoxide of lead, not being peroxidised, must be reduced; so that, a few moments after the immersion, we may see whether or not coloration will take place.

With respect to the preparation of iron or steel, when the plate has been polished, the surface is rubbed with alkalised water, and washed in a large quantity of water.

PROCESS OF COLORATION.

When a saturated solution of protoxide of lead in potassa, of the degree of density indicated, is submitted to the action of an apparatus composed of a few pairs, taking for the negative electrode a wire or plate of platinum, and for the positive electrode a plate of gold or platinum, there is immediately deposited on the latter, a layer of anhydrous peroxide of lead, which gradually increases in thickness, producing successively all the effects of color which the colored rings or fine films present. As soon as the coloration is terminated, the colored plate must be withdrawn from the solution of lead, and washed in a large quantity of water, in order to remove all the potassa, which would immediately re-act on the peroxide and convert it into protoxide, which it would dissolve. The coloration ordinarily commences at the edges of the plates at the parts farthest from the points of detachment, where, consequently, the chemical action of the current is strongest. It is for this reason that, without previous precautions, it is impossible to obtain uniform colors. The layers of peroxide of lead adhere so strongly, that they bear burnishing with leather and English rouge, and not burnishing with bloodstone or a steel or horn burnisher, because this operation can be applied only to malleable substances, the particles of which give way under the burnisher—a property which peroxide of lead does not possess, this substance being detached from the surface on which it is deposited, when the action of the burnisher is sufficiently strong. Besides, the adherence

of the peroxide is so much the firmer as the metals, at least their oxides, are more inclined to form combinations with this compound. This adherence is sometimes so powerful, that the deposit for a long time resists the action of dilute acids. Peroxide of lead not being a conductor of electricity, it results that the thickness of the colored film is extremely limited. Before detailing the different processes which we have adopted for obtaining all the desired effects of color, I must point out the order which the coloration follows, in order that we may be able easily to analyse all these effects.

ON THE DIFFERENT ORDERS OF COLORATION.

The coloration obtained on metallic surfaces, by the deposition of successive layers of peroxide of lead, is due, as I have said, to the phenomenon of thin films, which show, by their transparence, when there is no oxidation, the metallic surface on which they are deposited. If this surface is colored, the colors depending on the thickness of the films, combine with that which is proper to it; whence result effects which, although altering the colors of the colored rings, do not change the succession of the different orders, which are no longer composed of simple colors. With gold, for example, it is impossible to obtain blue, since its yellow color, mixing with the blue, gives a blueish-green—very beautiful, it is true, but which is not the blue of the colored rings. With platinum we obtain blue—ultramarine blue—the most beautiful blue which can be obtained. I will now point out how the colors, due to the deposit of successive layers of peroxide of lead, succeed one another on a plate of gold.

FIRST ORDER.

First order of the colors of Newton's colored rings :—

Black, very pale blue, vivid white, orange yellow, red.

First order of the colors of the films of peroxide of lead : —

Slight deposit, whose color is so fugitive that it cannot be characterised ; orange, deep orange, pearl grey verging on greenish, golden yellow, light red, beautiful prismatic red.

SECOND ORDER.

Second order of the colors of Newton's colored rings :—

Dull purple, purple, bright grass green, bright yellow, rose lake.

Second order of the colors of the layers of peroxide of lead :—

Red verging on violet, blueish green, fine green, yellow, red.

THIRD ORDER.

Third order of Newton :—

Blue purple, bright grass green, brilliant yellow, rose lake.

Third order of the films of peroxide of lead :—

Wine violet, deep green, green verging on red. The colors beyond take more and more a deep aspect, and, finally, become jet-black.

By comparing the colors of Newton's colored rings, with those of the layers of peroxide of lead, belonging to the same order, very manifest relations are seen, since, with a few exceptions, the only difference is in the tints ; the order of colors succeeds very well.

On copper, the same orders of colors are observed, with the exception that they are not mixed with yellow, but, indeed, with a reddish tint, which gives intensity to them.

On perfectly polished silver, a greenish yellow color, partially due to the oxidation of the silver, is first observed, then yellow, red, blue and green, and, afterwards, other colors, which become more and more deep.

On platinum, all the foregoing colors take more and more a blue tint ; also, those which are blue or bluish-green, give the finest blue—the brilliant blue of ultramarine.

On iron, and especially on steel, the different orders of colors are thrown with considerable intensity, but, in general, they are colored by the grey color of the metal; I have experimented on the metals void of color, and on those which present deep colors. I will examine, in another memoir, the effects obtained on nickel, cobalt, &c.

(To be concluded in our next.)

ON POTATOE OIL AND THE PURIFICATION OF BRANDY.

BY PROFESSOR DOBEREINER.

It is known that the brandy of potatoes, infected with the disagreeable taste to which the name of *fusel* has been given, is much ameliorated, with respect to both taste and odor, when mixed with one-tenth part of its bulk of vinegar and a little sulphuric acid, and distilled after several days.

It was formerly, and still is, believed, that by this process a little acetic ether (acetate of oxide of ethule) is formed, and that this is the cause of the improvement of the brandy. This is an error, for very little or no acetic ether is formed, but, indeed, acetate of oxide of amylol, which has so agreeable a taste and odor of fruit, that it may be employed for perfuming apartments and for the preparation of ratafias of fruits ? The

readiness with which oxide of amylol combines with acetic acid, is infinitely more considerable than that which oxide of ethule exerts, and does not require, like the latter, the aid of a mineral acid.

The action of chloride of lime on the brandy of fusel, which I discovered more than 36 years ago, has no other origin, since the hydrated oxide of amylol or potatoe oil, is metamorphosed by the salt, and thus converted into an ethereal substance of an agreeable taste.

Perfectly calcined wood and animal charcoals separate the potatoe oil completely, in brandy which contains it, only when the liquid has been previously diluted with water, by means of which, the force with which the alcohol contains this oil in solution is diminished. In rather concentrated brandy, or alcohol, this oil cannot be separated by any kind of charcoal.

The most simple mode of removing the fusel from brandy, consists in rectifying it in Pistor's disinfecting apparatus. The oil of fusel is thus collected, as a secondary product, in such large quantities that it may be used for the purposes of illumination, on account of its brilliant flame, or for other uses in the arts. I received some time ago several quarts of this oil, from an establishment for the disinfection of brandy at Magdeburg, and I have been enabled to study its properties, principally with relation to the purification of the brandy of potatoes; the results which I obtained are those above alluded to, and I have also completely convinced myself of the correctness of the opinions of MM. Cahours and Dumas, who regard the fusel of potatoe brandy as analogous to alcohol and pyroxylic spirit.

I will call this oil, on account of this analogy, *amylol*, and will only remark that it acts with finely divided platinum in the same manner as spirit of wine and pyroxylic spirit: thus, when it is put in contact with these liquids, in presence of atmospheric air or oxygen, it absorbs four atoms of this gas, and forms one atom of valerianic acid and three atoms of water.

In a German vinegar manufactory, I remarked, some time ago, a very evident odor of valerianic acid, and I very soon discovered that, for the preparation of vinegar, potatoe brandy which had not been disinfected, was used. It would certainly be interesting to ascertain whether in the vinegar-mother liquors, there is not alcohol alone, but, also, potatoe oil or amylol, which might be oxygenised, and whether we might not find, in commerce, vinegars made from alcohol containing valerianic acid. It appears probable that pyroxylic spirit, diluted with much water, might be oxidised in these apparatus and converted into formic acid; it is an experiment which I recommend to those who are in a position to make it.

EXPERIMENTS ON THE FATTENING OF GEESE.*

BY M. J. PERSOZ.

I PROCURED ten geese of the same age and of equal strength. They were kept without food for about twelve hours, and weighed at that time, in order to establish their respective weights. One of them, No. 10, was immediately bled; and I determined—

	kil.
1. The weight of the blood equal to	0·157
2. That of the fat surrounding the intestines.....	0·100
3. That of the fat found in the subcutaneous tissue and the other parts of the body.....	0·210
4. And, finally, the weight of the liver	0·061

By means of these data, I calculated the respective weight of each of these parts in the nine remaining geese at the time when they were first submitted to nourishment by maize. The numbers resulting from this calculation are given in one of the Tables annexed to my memoir (Table C.), opposite to the weight of these same parts given by experiment.

The quantities of maize consumed by these nine geese are expressed in Table A. It will not be observed without surprise that one of them, No. 2, ate as much as 650 grammes per day, which formed nearly one-fifth of its weight.

In order to be able to estimate the quantity of fat formed in them, I weighed them all at stated periods: these weights were taken immediately before the evening meal, which was given twelve hours after that of the morning, and, in order to arrive as near as possible at the exact cypher of the increase, I subtracted from each of the weights the weight of half of the last meal. Thus, for example, the goose No. 1 was weighed on the 4th of December, in the evening; its real weight was 4 kil. ·055; but, as it had eaten in the morning 217 grammes of maize, I adopted the cypher 4 kil. ·055—108 = 3 kil. ·947. By acting thus, it appeared to me that I entered, as much as possible, into the conditions in which the geese were found when they were weighed for the first time.

We see in Table B. the interval at which the different mixtures were made (7 days), and the increase which each goose experienced during each period. In column *a* of this

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* *Comptes Rendus*, No. 7.

same Table are given the numbers representing the mean of increase for each day ; in column *e* is found the quantity of maize consumed by each goose. The cypher of the increase of the geese, multiplied by 100, having been divided by the quantity of maize employed, the relation existing between the quantity of maize consumed and the increase of the geese may be established in *f*.

In the 10 first columns, *aa*, *bb*, *cc*, *dd*, *ee*, of the Table C., we set forth the calculated quantities of blood, of liver, and of fat, which we suppose to exist in geese not fattened, with the corresponding quantities of blood, liver and fat found in geese after being fattened. In column *f* are found the numbers representing the quantity of fat which was formed during the alimentation. These numbers were established by subtracting, from the whole of the fat collected, the quantity considered to exist, already formed, in the lean geese. In column *g* is represented the total augmentation of each of the geese, in order that the cypher of this augmentation may be compared with that which expresses the quantity of fat extracted from each of them (see column *e*). In column *h*, figure the quantities of maize consumed by each goose ; in column *i*, the quantity of fat which this maize represents ; finally, in column *k*, are found the numbers representing the difference which exists between quantities of fat which were formed by nourishment with maize (column *f*), and the quantity of fat found in the maize, admitting, which really cannot be, that this latter is entirely used by the goose.

By glancing at Table A. it is evident that the geese did not bear the regimen of alimentation above described during the same number of days ; that some were obliged to be killed at the end of the 19th day, whilst others could be gavees until the 24th. In this country, all those who are occupied with the fattening of geese agree in stating, that a goose cannot be fattened with profit if it is necessary to kill it before 18, or after 24 days' fattening.

From columns *a* and *b* of Table B. it is evident that all the geese increased in weight ; but that this increase was slight in the geese Nos. 1 and 5, both of which, in consequence of an unfortunate influence, lost considerably in weight in the space of two days.

	Kil.
The goose No. 1 weighed, on the 14th of Dec.....	4·350
And on the 16th it weighed only	3·755
Difference or loss.....	0·595
The goose No. 5 weighed, on the 18th of Dec.....	4·458
And on the 20th it weighed only....	4·016
Difference or loss.....	0·442

On the 24th of December, the woman who was charged with the care of my geese informed me that No. 1 must be bled immediately ; because, said she, if the gavees be continued, not only would the food not profit it, but also the animal would lose in weight. Being curious to verify this assertion, I continued to treat it as above, and I saw with the greatest surprise, that on the second day it had lost, as I said above, 0·595 kil.

During this period, which I will call the period of disaggregation, the excrements of this goose were lactescent, and contained, as I found afterwards, much more fat than those of the other geese. It was from this liquid and milky characteristic that the woman had judged it necessary to kill the goose No. 1.

This phenomenon of disaggregation appeared to me so interesting, that I made arrangements for studying it in all its details on the goose No. 5, but the latter stuffed.

I did not fail, at the first opportunity, to examine this fact, which appeared to me worthy of attention.

I should mention, that the augmentations which correspond to the last two or three days of alimentation are not strictly accurate, and that, for the most part, they should be regarded as too high, owing to the bad digestion caused by the diseased state of the animal at the latter state of the fattening. Thus, in the digestive apparatus of certain geese, we found from 230 to 250 grammes as well of maize as of pultaceous matters, whilst in the intestines of the goose No. 10, killed before the fattening, there were only 55 grammes of excrementitial matters. By neglecting, therefore, these latter augmentations, and taking account only of those after from 14 to 20 days' alimentation by maize, it is seen that the augmentation, calculated with respect to the nourishment consumed, was always on the decrease, with two or three exceptions.

The numbers expressed in colums *a* and *a'* of the Table C. establish, except for the geese Nos. 1 and 5, that the weight of the blood was almost doubled in all. In the blood which was extracted from the geese fattened by maize, considerable changes were found. It was entirely red throughout, and at other times it is of a *pink white*, which is most commonly the case, and at other times it is white, and has the appearance of cream. In the second case, it is separated into two substances : the one, red, is deposited under the form of clots ; the other, more liquid, has physical properties which render it comparable to milk. This serous part contains only traces of albumen, for, when heated, or

treated by nitric acid, it gives only a slight coagulum.

Blood extracted from fattened geese differs also from that of lean geese, in the quantity of fat which it contains, and which is easily separated, under the form of an oleaginous liquid, by a simple desiccation of the blood in a stove, and more readily by ether.

As regards the physical properties of the fatty body which is found in the blood of fattened geese, they present much more analogy with the fat of maize than with those which are found either on the epiploon, or in the subcutaneous tissue; it is this that we hope to be able to demonstrate further on, by the comparative study of the chemical properties of these fatty bodies.

Much fat is added to the liver of a goose thus fattened. It is evident, from the comparison of the numbers inscribed in columns *b* and *b'* of the Table C. that the augmentation of the liver was, with two exceptions, from five to six times the original weight of that organ. The livers of Nos. 1 and 5, instead of being close and white, like those of the other seven, were brownish, congested with blood, flaccid and spongy, presenting, in a word, all the physical characteristics resulting from a reduction of volume, which is explained by the loss which these two geese suffered, and to which the liver was also necessarily subject. We thought we remarked a certain relation between the development of the liver and that of the fat. Now, if this be true, the reverse should also be so; so that the relation which is proved during the assimilation should be maintained during the disaggregation.

That, under this last point of view, our observations may relate to the liver of lean geese, or to that of fat geese, we have always observed, that the weight of the liver is about half that of the fat extracted from the intestines, and about one-fourth of the fat dispersed in the other parts of the body of the animal.

	No. 10. Not fattened.	No. 5. Fattened, but which stuffed.	No. 9. Fattened.
	kil.	kil.	kil.
Weight of the liver	0.062	0.160	0.335
Weight of the fat of the intestines	0.100	0.37	0.605
Weight of the fat found in the other parts of the animal	0.212	0.762	1.065

However, more importance than they really possess should not be given to these observations concerning the relations which exist between the liver and the fat of a goose, since they are based on only a small number of examples.

By comparing the numbers of column *e'*, which represent the absolute quantity of fat found in the fattened geese, with the numbers given in column *g*, which expresses their increase of weight, it is perceived that these latter, for the Nos. 1, 2, 5, 6, 7, 8, and 9, are inferior to the quantity of fat found. In the geese Nos. 1 and 6, not only is the cypher expressing their absolute increase of weight inferior to that which represents the whole of the fat, but it is also in this same number diminished from the weight of the fat which should be found in the lean goose. I estimate that, if I had been able to establish the real cypher of augmentation of the weight of the fattened geese, the exception which I have just noticed would not have existed, and that in all there would have been a portion of the animal itself which would have participated in some measure in the formation of fat. But this strict estimation was impossible, since, as we have said, there was in many geese undigested food, from which could not be deducted the unknown and undeterminable weight of fœcal matters which they contained when weighed at the commencement of the experiment.

In support of this proposition, that fattened geese are less fleshy than those which have not been fattened, I may state that in estimating the muscular fibre of a lean goose, I found 0·881 kil.; whilst, in estimating that of a fattened goose, I found only 0·798 kil. Now, if this proposition appears to contradict the observations of Professor Liebig, it must, doubtless, be attributed only to the operation mentioned by that celebrated chemist having been performed in quite different conditions from those on which we have formed our own opinion. In the first place, the goose fattened at Giessen weighed only 2 kilogrammes before the experiment, whilst the goose which we fattened weighed at least more than 3 kilogrammes: then it must be considered that the animal had not arrived at the period of increase, and that the maize which it consumed at first served for its development. In the second place, the goose in question, if it had been *gavee*, as is the custom in Alsatia, certainly would not have been able to support this regimen for thirty-six days. Now, the reason of its living so long was that it consumed daily less maize than ours. We see, indeed, that whilst ours consumed on the average 494 grammes per day, Liebig's goose con-

sumed on the average only 0·333 kil. We should remark, moreover, that this latter number would express the exact proportion of maize daily consumed by the goose of Giessen, only inasmuch as old maize was used, as we did at Strasburg, the nutritive value of which is much superior to that of maize collected within the year. This fact is so well known in this country, that old maize sells at from 15 to 16 francs the hectolitre, whilst the hectolitre of new maize sells for only 10 francs 50 centes.

We thought that this well-recognised superiority of old maize over the new, might be explained by the desiccation which maize undergoes during its exposure to the air, which desiccation, having the result of operating the reduction of maize, must increase its nutritive power. But, in order that this explanation may be fully satisfactory, it is necessary that, in adding the numbers expressing, first, the amount of this reduction; second, the interest of capital; and third, the *déchet*, a total be obtained whose cypher, added to that of new maize, would represent nearly the average price of old maize; now, this is not the case, as we shall show.

In order to ascertain the reduction which maize undergoes by exposure to the air, we compared together equal volumes of maize, old and new.

From weighings made in the market of our town, it results that the weight of a hectolitre of old maize varies from.... 72 to 78 kil.
And that that of a hectolitre of new maize varies from ..... 65 to 73 ,,

Difference ..... $\frac{7+5}{2}=6$

Again, by weighing on a smaller scale, I obtained the following results.

Old maize, of the same quality as that employed for fattening the geese on which we experimented:—

	kil.	
Weight of 1 litre..	0·767	Mean, kil. 76·73 the hectolitre.
,, ,,	0·765	
,, ,,	0·770	

New maize, which had just been egrené:—

	kil.	
Weight of 1 litre..	0·669	Mean, kil. 66·93 the hectolitre.
,, ,,	0·664	
,, ,,	0·675	

According to these data, we may, without fear of deviating much from truth, estimate at 10 per cent. the loss by desiccation. If, now, the interest of capital be rated at 5 per cent., and the *déchet* at 3 per cent., the total will be 18 per cent. to be added to the price of new maize.

The latter being about ..	francs	10·50
The interest and loss	,,	1·89
The price of old maize should, therefore, be only	,,	12·49
Instead of	,,	15·50

This comparison between the adulterated price of old maize and its real price, demonstrates that the preference which is given to it must be due, in great measure, to an unknown cause, or rather quality, inherent in this seed when it arrives at a certain degree of age. Can this quality be connected with the fact which we have noticed, and from which old maize would contain more oil than new maize? It would be temerity on our part to decide this at present. From 100 parts of maize collected in 1842, we extracted 7·850 of oil, and from 100 parts of maize collected in 1843, and *egrené* on the 20th of January 1844, we obtained 3·400.

If our attention had been sooner turned to this important point, we should have been able to make experiments on maize from the time of reaping, and to repeat our experiments from time to time, in order to ascertain whether, by becoming old, it really does or does not undergo, as well as many fruits and seeds, a kind of maturation having the effect of developing in maize a greater quantity of fatty matters.

If new experiments on this subject justify the isolated fact which we have just related, we should find the explanation of the disagreement which exists between the results obtained at Paris and Giessen, by equally skilful chemists, with respect to the quantity of oil which maize contains.

According to some, maize contains from 7 to 9 per cent. of fat.

According to others, it contains from 1 to 4 per cent.

And some say that it contains none at all.

The numbers inscribed in column *k* show the difference which exists between the weight of fat formed in the goose, and that of the fat contained in the maize consumed, and we prove imperatively that a large quantity of fat should be formed at the expense of the sugar and fecula of maize. But as when a goose which is being fattened digests well, its excrements* contain only bran, properly so called, with a certain quantity of fat, it must also be admitted that the fat of maize should, in all probability, contribute

* The weight of dried excrements, in our experiments, was from 12 to 15 per cent. of that of maize consumed. 100 parts of dried and finely powdered excrements having been treated by ether, we extracted from them from 9 to 10·8 per cent. of oil.

to a certain extent, to the fat found in the goose.

On the other hand, if the fatty bodies which are found in the aliments, exert on those which are nourished by it a well recognised influence, is this any reason why aliments in which there is no fat should be improper for fattening animals? Experiment has not yet proved this; for it is no answer to the question to say that pigs are fattened with potatoes. Are not either fatty waters or substances containing fat always added to this aliment? If so, nothing is determined in this respect.

The well-established fact of the diminution of albumen in the blood of fat geese, that of the participation which the very matter of the goose seems to have in the formation of fat, makes us think that we may perhaps arrive, by means of pure fecula, mixed with a nitrogenous matter (albumen), at compounding for geese an aliment free from fat. If by these means, which we are going to try, we arrive at nourishing them and fattening them, the question would be definitively settled, and this fact, joined to that of the diminution of albumen in the blood of the fattened geese, would then explain why those who experiment on fattening begin by *increasing* the flesh before *increasing* the fat. If, on the contrary, the result were negative, and if it were proved that a certain quantity of fat were indispensable to the fattening, our observations relative to the greater or smaller quantity of the fatty body which maize contains, according to whether it is old or new, would acquire much interest; for they would explain why old provender is preferable to knew, for feeding cattle; why, generally, in our country, more quality is recognised in corn *threshed* in January and February; and, finally, why those who cultivate maize leave it in *grappes*, and expose it to the air for a whole year under *hangars* or *toits*.

From what we have said, the goose being regarded as a laboratory in which fat is formed, it will be sufficient to estimate accurately, by means of appropriate apparatus, the gaseous liquid or solid materials, and those which are expelled or extracted, in order to establish a rational theory concerning the formation of fat, and to decide whether the oxygen acts directly or indirectly on fecula or on the sugar, in order to convert into fat these proximate principles.

We may sum up as follows:—

1. That, according to our experiments, the goose, in being fattened, assimilates not only the fat contained in maize, but that it forms a certain quantity at the expense of the starch and sugar of maize; and perhaps, also, by aid of its own matter, since the quantity of fat formed in it is ordinarily more than double that which is found in maize.

2. That, after being fattened, a goose contains a quantity of fat superior to the increase of weight which it has undergone.

3. That, during the fattening, the blood of geese changes in composition; that it becomes richer in fat, and that the albumen disappears or is modified.

4. That, finally, there seems to exist a certain relation between the development of the liver and the quantity of fat produced.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THE PHARMACEUTICAL EXAMINATIONS AND EXAMINERS.

Never, in the course of our experience, have we heard of a more puerile and culpable farce than that acted by those learned mountebanks of the Pharmaceutical Society, who have taken upon themselves the responsibility of examining those chemists and druggists who may apply for admission as members and associates of the society.

Every third Tuesday in the month there is to be seen, seated on one side of a long table, this self-elected *clique*, endeavoring to assume the physiognomy depicted in the common plaster busts of Plato, Aristotle, and Socrates. There they sit, big with their own importance, looking unutterable things, each with a piece of paper before him, on which is inscribed the questions (and also what is believed by him to be the answers to them) with which he intends to badger the solitary victim who sits on the other side of the table for examination.

To convey anything like an idea of the scientific ignorance and want of common sense which is exhibited by these questions and questioners, would be utterly impossible; however, we will give two or three specimens. "How many tinctures are there in the Pharmacopœia?" asks one of the examiners. The candidate, in reply, of course pleads ignorance, and looks as though he were afraid he would next be asked how many

letters are there—or how often the word "it" occurs—in the Pharmacopœia. A second will demand him "to state the proximate principles of opium, and their atomic constitution;" as though it were any proof of the possession of pharmaceutical knowledge to be able to give the parrot-like answers such questions require. As well might an examiner of Oxford desire a theological student to repeat from memory the Book of Genesis, as an evidence of his acquaintance with Divinity. A third examiner, looking more profound than the rest, will give him the following problem to solve:—"If a bottle holds, when filled with distilled water, 976 grains, and, when filled with another liquid, 1,133 grains, what is the specific gravity of the liquid regarding water as unity, and *name the liquid, judging from its specific gravity?*" The candidate of course answered the first part of the question correctly, and acknowledged his ignorance of the name of the liquid; when the learned examiner expressed his surprise with becoming gravity, and told him "that he ought to have known the liquid was muriatic acid, as the specific gravity of which in the Pharmacopœia was 1,16." Gracious Heaven! these worthies have discovered a substitute for chemical analysis to rival the universal solvent, and the days of alchemy. Let their "great fact" be recorded in the page of history: we will repeat it, that no man may forget it, "that the specific gravity of a substance is a means of detecting its chemical composition." They have completely demolished the law heretofore acknowledged by philosophers, that a body has different specific weights depending on its physical aggregation, and that different bodies have the same specific weight. Now, to speak in plain language, we implore these modern Bacons, if they have any regard for the welfare of their society, or respect for their own characters, to resign this self-imposed duty to some of those members of the Society (entirely excluding the Council as incapables) who, to our knowledge, are eminently qualified, by their scientific attainments, to perform the duties of examiners, and let them be paid a proper remuneration for their labor. We pledge ourselves, should these ninnyhammers not speedily effect the necessary reformation, to drag them forward by name (and we have ample opportunities of learning their proceedings, as they will perceive to their horror by the specimens above given), and to hold each individually responsible to public opinion for the unmeaning and disgusting balderdash to which he has given utterance.

LECTURES ON THE TESTS FOR ARSENIC.

BY DR. M. ROSENTHAL.

Two lectures were delivered by Dr. M. Rosenthal on the tests for arsenic, in the London Mechanics' Institution, on the 12th and 19th of April.

The lecturer commenced by pointing out the necessity for the toxicologist to be quite conversant with the symptoms and morbid appearances in cases of poisoning.

He next stated, that the report which prevailed a few years ago, that arsenic had been extracted from human bodies, particularly from the bones, though poisoning was out of the question, is without the least foundation; he had heard it stated by Professor Orfila himself, who, in 1839, promulgated this report, that he never after that time succeeded in obtaining traces of arsenic from a human body, unless arsenic had been purposely introduced.

He then regretted that, for want of time, only two lectures being allotted to him, he was compelled to confine himself to arsenious acid, which, of all the arsenical preparations, is most usually resorted to by offenders; and that, even of that particular substance, he could only mention the principal heads. He observed, that metallic arsenic is hardly endowed with any poisonous properties, but that its oxides and sulphurets are deleterious substances. He then enumerated and exhibited specimens of the different poisonous arsenical compounds, viz.:

The suboxide, or fly-powder.
The white oxide, or arsenious acid.
Arsenic acid.
Realgar, or bisulphuret of arsenic.
Orpiment, or sulpharsenious acid.
King's yellow.
Arsenic of copper, mineral green, or Scheele's green.
Fowler's solution, containing arseniate of potassa.

He next entered into details concerning the physical and chemical properties of metallic arsenic and arsenious acid, directing attention to the garlic odor which is exhaled at the moment when metallic arsenic is converted into arsenious acid. He observed, that too much stress ought not to be laid on that phenomenon, because it is produced by other substances (phosphorus, zinc, organic matter containing garlic), even when there is no arsenic present.

The number of tests for arsenic contrived, up to the present day, is very considerable, yet all are not valuable alike.

He divided the tests worthy to be noticed into—

1. Liquid tests.
2. The reduction test.
3. The oxidation test.
4. Marsh's test.
5. Reinsch's test.

Diagrams of the different apparatus required for testing, were then exhibited and explained.

I. LIQUID TESTS.

The liquid tests were arranged in a Table as follows:—

LIQUID TESTS.

Re-agents.	Arsenious Acid.		Arsenic Acid.
	Color of Precipitate.	The Precipitate is soluble.	Color of Precipitate.
Ammonio-sulphate of Copper.....	Grass or apple green.	In potassa or ammonia, with a blueish color...	Pale blueish green.
Ammonio-nitrate of Silver.....	Lemon yellow.	In ammonia and nitric acid, and in nitrate of ammonia.....	Brick red.
Sulphuretted Hydrogen.....	Canary yellow.	In ammonia.....	Light yellow.

After the precipitates had been thrown down by the liquid tests, and exhibited, the lecturer showed that a grass-green precipitate may likewise be obtained from a decoction of onions or raw coffee, by ammonio-sulphate of copper; but that the precipitate thrown down from the decoction of onions by the ammonio-nitrate of silver, though yellow at first, soon takes a dark shade, and the precipitate obtained by the nitrate from a decoction of coffee, is instantly black.

There is no substance in existence which, with all the three reagents, would strike the respective colors.

II. REDUCTION TEST.

Three tubes were then shown in the diagrams; the one destined to contain a splinter of charcoal; the second, charcoal in the state of powder; the third, tartrate of lime: they were intended to serve for the reduction test.

By *reduction test*, is meant the process tending to separate the metal from such substances as it may be combined with: charcoal and lime not being volatile, will stand a high degree of heat; whereas the arsenic will fly off and adhere to the distant and colder portions of the sides of the glass tube.

III. OXIDATION TEST.

The oxidation test consists in converting the metallic arsenic into arsenious acid.: this test chiefly is employed when there is a doubt left whether the black or steel crust produced by the reduction test in the glass tube be really arsenic or organic matter, or some other substance: the tube must then be open on both ends in such a manner that a continued current of air may have free access; the spot of the tube which contains the crust is to be heated to redness, when the white oxide will be produced, exhaling the garlic odor: the white oxide or arsenious acid obtained in this way, on being dissolved in distilled water, may be tested by the three liquid tests by the means of a lump of chalk, as is advised by Mr. Herapath, of Bristol. [See his Letter, at the end of this article.]

IV. MARSH'S TEST.

The apparatus consists of a glass tube $\frac{3}{4}$ of an inch in diameter, bent in the form of the letter U, presenting two perpendicular legs, the one measuring eight inches, left open at the end, the other measuring five inches, provided with a stopcock, a jet of a fine bore being attached to it.

The apparatus modified and used by Professor Orfila, is constructed on the same principle, though the apparatus is differently shaped; it consists of a wide-mouthed bottle, provided with a cork, in which two holes are made, the one receiving a funnel, which reaches nearly to the bottom of the vessel, the other a tube bent in a right angle, the latter containing in its horizontal branch some asbestos, having no stopcock attached to it, but being drawn out at one end in a jet of a fine bore.

The materials to be employed are those required for disengaging hydrogen, viz., water, sulphuric acid, and zinc. These having been placed in the apparatus, the issuing hydrogen gas is inflamed; but, in order to prevent explosion, this must not be done until all the atmospheric air is expelled, which may be ascertained by approaching the opening of the jet to the under lip, when a current of air will be felt as soon as all atmospheric air is driven off. The hydrogen so inflamed will combine with the oxygen of the air, and form watery vapor, and if a cold body, a china saucer for instance, (to prevent mistakes it ought to be real china, there being lead in the glazing of ordinary ware, and stains of lead might be extracted from the saucer,) be held against it, no change will be produced on its surface; but if a substance containing metallic arsenic or its acids be placed in the Marsh's apparatus, then the arsenic rises with the hydrogen constituting arseniuretted hydrogen; and, issuing through the jet, on being inflamed, the hydrogen will combine with the oxygen of the air, forming water, and the metal will be deposited on any cold body (a china saucer) held against it, under the form of fallow-brown bright metallic stains, and if in the case of Marsh's apparatus, as made use of by Professor Orfila, a spirit lamp be held under that portion of the bent tube which contains the asbestos, the arseniuretted hydrogen will be decomposed already in the tube, and, at some distance from the heated spot, the glass tube will be lined on its interior sides with a black steel-greyish coating, which is metallic arsenic, and is called the *arsenical ring* (*l'anneau d'arsenic métallique*, Orfila).

Before, however, we begin to operate, we must be assured that the sulphuric acid and zinc are of themselves not contaminated with by arsenic, which is to be ascertained by introducing them into the Marsh's apparatus without an admixture of any suspected substance.

An apparatus was exhibited, which was contrived by Mr. Morton, of the Royal Veterinary College, which is calculated to disengage the hydrogen gas by decomposing the water merely by the influence of an electrical battery, thus doing away with the necessity for zinc and sulphuric acid; an ingenious contrivance, for which the thanks of the Society of Arts have been awarded to him. To use hydrochloric acid instead of sulphuric acid, is by no means advisable, for it furnishes chloride of zinc, which, being volatile, forms stains much similar to the arsenical ones. Besides, the hydrochloric acid is frequently arsenical, and is then most difficult to be freed from that impurity; and, finally, it sometimes contains sulphurous acid, which, on being transformed in the Marsh's apparatus into sulphuretted hydrogen, will throw down the sulphuret of arsenic, and that, not being acted upon by the Marsh's apparatus, we should altogether fail in detecting the arsenic. If, instead of arsenic, antimony be contained in the Marsh's apparatus, stains will be collected greatly resembling those of arsenic; yet the following will guide us in distinguishing the one from the other with the utmost certainty:—

1. The arsenious stains are of a fallow-brown, and bright metallic lustre; those of antimony are blueish, and, if thick, of a dark color.

2. The stains of arsenic will instantly disappear if exposed to the flame of a hydrogen lamp; those of antimony will resist six or seven minutes, and will always leave a greyish spot behind.

3. The arsenical stains are immediately detached from the saucer on being treated by a few drops of nitric acid, though not dissolved in it.

4. If the nitric acid containing the arsenical stains be evaporated, the residue will be a mixture consisting, for the most part, of arsenic acid, and, to a small extent, of arsenious acid; this residue, on being dissolved in distilled water, and treated with nitrate of silver, will throw down a brick-red precipitate.

5. This same residue, treated with sulphuretted hydrogen, will throw down a canary-yellow precipitate.

6. A solution of chloride of sodium will instantly take off the arsenious stains, but not those of antimony.

V. REINSCH'S TEST.

The matter to be examined is to be boiled with hydrochloric acid, slips of bright copper sheet being introduced therein; the copper, in the presence of arsenic, will be covered with a steel-grey coating. This test is most delicate, but it is to be regretted that the hydrochloric acid is generally arsenious, and even the copper is almost always contaminated with the very poison itself. If the matter to be examined is a watery solution, it is fit for the tests; but if it be viscid and mixed with some organic substances, as milk, white of an egg, it requires boiling and filtering previous to being tested. But for Reinsch's test no preparation is requisite.

If no arsenic can be found, neither in the contents of the stomach nor in the vomited matters, then we may discover it in different organs of the body, chiefly in the liver and spleen, in the blood and urine. The process

consists in deflagrating the matter by nitre, in the state of fusion. (*Vide* Mr. Herepath's letter.)

To decide upon the value of a test, we consider—first, its delicacy; next, the degree of certainty with which the experimentalist may rely on it; and in both these respects Marsh's test takes precedence, and is most deservedly allowed, by all toxicologists of any standing all over the world, to be the best ever proposed, and the only decisive of itself.

To obtain authentic information with regard to the case of the two females Sealey, who very lately stood indicted for parricide, the lecturer applied to the medical witness, the celebrated chemist and toxicologist, Mr. Herepath, of Bristol, who kindly replied in a highly concise and instructive letter, which, having been publicly read, we have thought it might be serviceable to our readers by giving it entire:—

In conclusion, the lecturer exhibited a specimen of hydrated peroxide of iron, as the best antidote against arsenic, and wished it to be known that it is erroneously advised to make use of it in the state of a paste, because in that case 400 grains of it (nearly one ounce) can neutralise only one grain of arsenious acid; whereas this substance, when dried at about 100° F. in a water bath, will take up no less than 16 grains of the same poison, if as much as one ounce of it be given.

The following is Mr. Herepath's letter:—

"To Dr. M. Rosenthal.

"Sir—In reply to yours of yesterday, allow me to say that it is quite true that I found the arsenic, in the case of Sealey, in the state of orpiment, and I must add that it is almost always found in that state when a body has been buried for any considerable time, or rather, when sulphuretted hydrogen gas has been developed by putrefaction. Thus, in the case of Mrs. Smith (for whose death Mrs. Burdoch was executed), who had been poisoned by red arsenic (realgar), it was wholly converted into yellow. This exhumation occurred after fourteen months; this of Sealey's, with arsenious acid wholly converted, after nine months; in the case of Mary Hounsel, near Dorchester, principally converted, in eleven weeks. I have found the same effect produced on animals in two months, and it is not simply a *conversion* of red or white into yellow—it produces a combination of the orpiment with animal matter. The poison penetrates into and even through the texture of the stomach, and unites with it, so that the infiltrated spots might be washed, scraped, or otherwise roughly treated, without the stains being removed from either the out or the inside. In Sealey's case the pancreas presented the same appearance; even the yellow paste remaining loose on the inner surface of the stomach is a compound of orpiment and animal matter, and it is this which renders the separation or isolation free from embarrassing appearances so difficult. It is only in cases where a considerable quantity of arsenic has been given, that the orpiment appears. In some instances, such as that of William Howell and his nurse, at Bridgend, last year—in one of the bodies the whole of the arsenic had passed from the stomach and upper intestines, and was only found in the lower one; and in the other body none was found in the stomach or intestinal canal, while the liver furnished me with abundant traces.

"The process which I generally depend upon when large quantities of animal matter are present, is this: I add a solution of nitre to the matter, and evaporate to dryness; this is projected, by small portions at a time, into nitre kept in a melted state, in a pure silver crucible; when every thing is burnt off that in the crucible is dissolved in water and filtered; it is now supersaturated with pure acetic acid, and a stream of hydrosulphuric acid has passed through it, and the excess of the latter removed by boiling; it is now allowed to subside for 12 hours, when the supernatent fluid is removed by a pipette, and the yellow precipitate (for sulphur is always there) is washed and dried; it is now sublimed with the usual precautions in

the reducing tube, and having produced the metal, the ball is cut off, and by heat and a stream of air it is sublimed as arsenious acid; as a second test, it is then dissolved by two or three drops of boiling water, one drop being placed on a white porcelain plate, it is tested with ammonia, sulphate of copper; another with ammonia, nitrate of silver; and a third has a stream of sulphuretted hydrogen transmitted through it; but in this part of the process I have introduced a great improvement.

"I have before me a lump of chalk with a clean and smooth surface; upon this I put a bit of white blotting-paper, the drop tested is allowed to run down a glass rod and fall on the blotting-paper; the fluid parts are immediately absorbed by the chalk through the paper, when the green of scheele and the yellow of the other two tests are left on the paper, and are very much more evident than by the old way. It is almost inconceivable how small a quantity can be thus made evident. By this process I sacrifice much of the arsenic present during the deflagration of the nitre, but the remainder is infallibly detected, and I prefer it to that which destroys the animal matter by nitric acid, as the ordinary nitric acid *often contains arsenic*,

having been made from sulphuric acid obtained from pyrites.

"The present case is the only one I know of where Reinsch's test has been used when all the arsenic has been converted into orpiment. I cut out a small portion of a yellow spot in the duodenum and boil with much pure hydrochloric acid; while still boiling I introduced a polished copper wire; after allowing it to remain there for some time, I removed it, washed the stain on its surface with a stream of water, dried it, and then scraped the metal and put the scrapings into a very small tube open at both ends, held inclined outwards: upon heating thus in a stream of air arsenious acid sublimed, this was dissolved and treated as above, when the presence of arsenic was undoubted. I think it a prompt and most useful process where the metal is contained in something like quantity, but totally inapplicable where, as in the case of Howell, there might be perhaps $\frac{1}{100}$ of a grain in a pound of liver.

"I am, Sir, yours respectfully,

"William Herepath.

"Bristol, 16th April, 1844."

[We understand that Dr. Rosenthal intends shortly to give a course of six lectures on the above subject, adapted for members of the legal and medical professions.]

ON THE SYRUP OF IODIDE OF IRON.

BY WILLIAM ONION.

It is well known that an aqueous solution of iodide of iron soon undergoes decomposition if kept by exposure to the air, the iron absorbing oxygen is precipitated as a peroxide in conjunction with the iodine. It is also well known that the solution of the same iodide in syrup does not so readily change. From whence arises this difference? *In part*, it may be attributed to the viscidity of the solvent preventing in some degree the action of the air; but other causes are in operation: by long keeping, decomposition takes place in the syrup, but not with like results as the aqueous solution. Messrs. E. and H. Smith, in the *Pharmaceutical Journal* of last month, have speculated upon these points, but they do not appear to place much reliance on their opinion, as they recommend further observation and experiment. They consider that either acetic, formic, or oxalic acids may be present in the syrup when kept, but the change does take place in a bottle closely stopped, and containing only a small portion of air; and again, pure oxygen gas will not in a degree commensurate with their views, nor accelerate the process; so that, considering the immense quantity of oxygen which would be required to convert the sugar into oxalic or formic acids, we may reject their opinions; moreover, it is scarcely probable that acetic acid would be present unless the sugar or syrup underwent fermentation; but, furthermore, I have not been able by any means to detect the *least trace* of any of these acids; the only acid present in the syrup was a small portion of carbonic acid, which was no doubt accidental.

The syrup which was the subject of my examination, the details of which are here related, was prepared by the process recommended by Dr. J. Todd (see The Chemist, No. 37), and contains three grains of the iodide of iron in the fluid dram. It had been kept partially excluded from the air about four months; was slightly acid to litmus paper, owing, no doubt, to the presence of a *persalt* of iron; it had a deep reddish-brown color, and contained a *black deposit*.

My opinion is, that the following are the changes which take place in the syrup when long kept:—By the action of atmospheric oxygen, a portion of the iron is peroxidised, combining with the sugar, forming a saccharate of iron; the iodide of iron is thus converted into a sesqui-iodide; by the further action of the air, another portion of iron is thus altered, and so on, until the whole of the iron is peroxidised, and exists in chemical combination with the sugar, the iodine being precipitated. This opinion is based on the following experiments and reasoning.

It is a well known fact, that sugar in many instances acts the part of a weak organic acid, neutralizing bases, and acquiring stability by its union, as in the saccharate of lead, &c.; some sugars are of themselves ascescent, and others acquire it from the presence of animal matter introduced in their clarification, but I here allude to perfectly pure sugar. Sugar possesses the property of combining with peroxide of iron, and so strong is their affinity, that when in solution we cannot separate the whole of the peroxide by ammonia. We will now see how far the syrup under consideration tallies with the above; the black precipitate by an accident was lost, but I have not the least doubt in my own mind but that it was iodine. A solution of starch was added to the syrup; there was an immediate blue discoloration. A current of hydrosulphuric was passed through another portion, sulphur was deposited and hydriodic acid formed, the solution became nearly colorless. Another portion of syrup evaporated did but crystallize, and the filters were colored when the syrup was passed through them. These experiments evidently establish the presence of free iodine; they were varied, viz., by first precipitating the peroxide of iron, but the above results were always obtained.

Now, as to the state and presence of the iron :—A solution of ammonia was added in excess, it was then heated to expel free ammonia, filtered ; to the filtered liquid a drop of nitric acid was added, and then solution of ferro-cyanuret of ammonia gave a distinct blue precipitate. A recently prepared syrup gave with the prussiated alkali a very light blueish white precipitate, whilst the other syrup gave a deep blue precipitate ; these experiments were likewise varied, and many others besides were executed, which I need not fill space by enumerating ; they all tend to support the opinion given above—that the iron exists in the syrup when long prepared as a saccharate of peroxide of iron, and that, with the exception above-mentioned, no other acid could be detected in it. I regret being unable to examine the black deposit, but I hope to do so at some future period. As a concluding observation, may I hazard the opinion, that the reason why the syrup of iodide of iron remains without decomposition longer than the aqueous solution, is owing to a saccharate of protoxide of iron being originally formed, which, by further absorption of oxygen, becomes a saccharate of peroxide of iron—the protosalt being colorless, while the persalt is of a reddish-brown tint ?

A PHARMACEUTICAL DISCUSSION.

The following is a Report of a Discussion which took place at the Pharmaceutical Society, upon Mr. Bell's paper on Copaiba Mixture, and not before published, it being the opinion of the Council that it was too scientific for the readers of their Journal.

The President (Mr. Payne) was sure there were many members present who could offer some valuable remarks upon this very excellent *practical* paper, which showed what difficulties "*poor Pill Garlic*" had to encounter in making *nice* Copaiba Mixture.

Mr. Waugh thought Copaiba Mixture was never *nice* under any circumstances ; he had found Copaiba Pills very useful.

Mr. Ince begged to ask if any gentleman had tried Copaiba in powder.

Mr. Squire saw great difficulty in pulversing Copaiba ; he had had the subject for a long time under consideration.

Mr. Savory was sure the Copaiba now in the market was not generally pure, which he believed was *the cause* of the difficulty in powdering it.

(Here several members rose, and declared that the *lowness* of price produced the adulteration of Copaiba.)

Mr. Herring perfectly agreed with the gentleman who had last spoken ; he had a large stock of *pure* Copaiba, which he could not afford to *sell* at the usual market prices.

Mr. Redwood exhibited an apparatus, which he believed was admirably contrived for powdering Copaiba.

The President begged to know from the medical gentlemen present, what would be the effect of *powdered* Copaiba on the constitution ?

No answer being obtained to this question, the discussion here concluded amidst a round of applause from the members and associates.

[The above is reported by a benevolent individual, who subscribes two guineas annually for the benefit of the Council of the Pharmaceutical Society, or, in symbols (not chemical) is a M.P.S.G.B.]

ADULTERATION OF TAMARINDS.*

BY GIOVANNI RUSPINI.

It is certainly useful that this medicine, now so generally used, should be analysed with care, for only very defective qualities of this fruit are now to be found in commerce, either because it is not gathered at the proper time and with proper care, or because the more considerable consumption has induced those who deal in it, for the sake of profit, to adulterate it, either in the sea-ports, or in the places where it has been gathered. The fact is, that now there is imported only the *Tamarindus indica*, in reddish cakes mixed up with remains of husks, and, more frequently, mixed with ordinary gums, in order to give these cakes a flattened, spherical form, without which they would not be credited in commerce. Without this mixture of gum, the cakes would not retain their form, deprived as they are of pulpy substance.

A great quantity of the tamarinds, now sold, do not give, by maceration, the black color, nor the taste resembling wine, as obtained with the tamarinds of former times ; but the decoction is reddish, turbid, has a disagreeable acid taste, and, when scarcely cold, allows an abundant precipitate to accumulate at the bottom of the vessel. In the following instance I was the dupe of an adulteration of tamarinds :—

Having bought a large quantity of tamarinds in paste, I was astonished at its brilliant black color, and, on rubbing it between the fingers, I found this paste very unctuous. But what was my surprise when, having taken water to wash my hands, I perceived that they were stained black, which made me suspect some alteration, and my sus-

* *Annuaire des Sciences Chimique.*

picions were but too well confirmed. In order to assure myself of the fact, I took two pounds of tamarinds; I added to them about twelve times their bulk of water, taking care to stir constantly with a wooden rod. I afterwards decanted the liquid, as well as the supernatent matter, and poured on the residue a new quantity of water; and, after a new decantation, I collected at the bottom of the vessel a black powder possessing all the physical characters of animal charcoal, which blackened the hands, and which, treated by diluted nitric acid, partially dissolved, with effervescence: this nitric solution, treated by oxalate of ammonia, gave a white precipitate.

I was able to break my bargain, and to compel the vendor to take back his merchandise; but it often happens that fraud, skilfully disguised, is not discovered. The analyses of most samples of tamarinds would not give the principles recognised by Vauquelin in the analyses which he made of this medicine.

It would be desirable that, in order to prevent the very common adulteration of this fruit, and of many other medicinal substances, that the drugs be inspected at the time of their disembarkment, or in bond.

THE EMBALMING OF THE BODY OF MARSHAL D'ERLON.*

The following is the method by means of which Dr. Broc proceeded to embalm this body, by the injection of the carotid artery:—

500 grammes of corrosive sublimate were dissolved in 2,000 grammes of alcohol (about two quarts).

25 grammes of arsenious acid were dissolved in half a pint of warm water.

4 grammes of essence of cloves, 15 grammes of essence of lavender, and 5 grammes of orange, were dissolved in 2 quarts of alcohol.

At the moment of injection, the three solutions were mixed.

Three-fourths of the mixture were injected into the inferior end of the left carotid artery; the remaining fourth was distributed, after previous punctures, into the two pleuræ and into the peritoneum. By means of several punctures, the gases of the intestines were evacuated. The body was afterwards wrapped in linen bands.

It is essential not to inject into the vessels of an adult more than three quarts of a liquid, otherwise the injection passes into the bronchi, and flows out of by the mouth in great abundance.

* *Journal de Chimie Médicale*, March, 1844.

ON THE COLORATION OF DIFFERENT KINDS OF FECULA BY THE VAPOR OF IODINE.*

BY M. GOBLEY.

When we put in contact with iodised water or tincture of iodine, starch, potato fecula, or arrow-root, these substances immediately take a blueish color, whose intensity is insensibly the same in all, which does not enable us to distinguish by this means one of these feculas from another; but if, instead of acting thus, these bodies be exposed to the vapor of iodine—if, for example, a certain quantity of these feculas be put into watch-glasses, and if these glasses be placed under a bell-receiver containing iodine—these three bodies seem to acquire, after 24 hours, a color sufficiently different to admit of their being distinguished from one another.

If the other feculas employed in medicine assumed, in the same circumstances, each a different color, the pharmacien might, by this simple means, ascertain whether those which he buys in commerce are genuine or factitious, or whether they have been mixed with feculas of an inferior price. It is important, with respect to fecula, not to give a factitious for a genuine product, for the true taste of arrow-root, tapioca, and sago, is very different to that of the factitious products; the first are to the second, as well observed, as the wine of Volney is to the best wine of Suresne.†

* *Journal de Chimie Médicale*, March 1844.

† Factitious arrow-root has the granular appearance of genuine arrow-root.

Whole genuine sago is easily distinguished from factitious sago. Genuine sago, as now met with in commerce, is under the form of small, irregular grains, very hard to bite, sometimes white, sometimes pink. Genuine pink sago is very rare, and almost all that of commerce is only white sago colored by carmine. It is easy to detect it, either by treating the pink sago with ammonia, as Planché recommended, or by treating it with alcohol. In order to try this mode of testing, as I have done myself, ammonia and alcohol dissolve the coloring matter, and take a pink tint.

Factitious sago has almost the hardness of genuine sago, but the grains are larger and more uniform; they are also much whiter than those of genuine white sago. Thus, these two sagos are easily distinguished from one another.

Whole genuine tapioca is easily distinguished from factitious tapioca. The former

Stareh	Violet eolor.
Potato fecula	Dove-grey.
Genuine arrow-root	Light chocolate color.
Arrow-root with one-fourth of stareh	Grey lilac.
Factitious arrow-root	Dove-grey.
Genuine whole tapioca	All the grains yellowish.
Powdered genuine tapioca	Chamois eolor.
Powdered genuine tapioca mixed with one-fourth of starch	Violet eolor.
Whole factitious tapioca	Some grains violet-grey, others yellowish.
Powdered factitious tapioca	Chamois color.
Powdered factitious tapioca mixed with one-fourth of stareh	Violet eolor.
Whole white sago	Some grains violet-grey, others yellowish.
Pulverised white sago	Chamois eolor.
Pulverised white sago mixed with one-fourth of stareh	Violet eolor.
Whole factitious sago	Some grains violet-grey, others yellowish.
Pulverised factitious sago	Chamois color.
Pulverised factitious sago mixed with one-fourth of starch	Violet eolor.
Dextrine	No eoloration.

It is evident, from this Table, that starch and potato feeula take, under the influence of the vapor of iodine, very different colorations; that arrow-root, which, when it is pure, takes a *light chocolate color*, assumes a grey lilac eolor when it is mixed with one-fourth of starch (potato feeula cannot be used for this purpose, for, on aceount of the greater diameter of its granules, the fraud would be too easily detected); and that factitious arrow-root acquires a dove-grey color, that is to say, the same coloration as the potota fecula which is used for preparing it; that whole tapioea and sago, genuine and factitious, take the same yellowish tint; and that the powders of genuine tapioca and sago, which many chemists buy in commeree, on aecount of the difficulty of preparing them, all assume a ehamois color.

Thus, by means of the vapor of iodine, starch may be distinguished from potato feeula, and genuine from faetitious arrow-root, or arrow-root mixed with starch. It may also be ascertained whether the powders of genuine and factitious tapioca are substituted by wheat or potato fecula, or mixed with them; but it is impossible to determine whether the powders of genuine tapioca and sago have been replaced by the powders of factitious tapioca and sago, since all these powders take the same chamois eolor.

Why do potato fecula, starch, and arrow-root, under the influence of the vapor of iodine, take a more or less deep tint, whilst genuine or factitious whole or pulverised sago and tapioca acquire only a yellowish tint? This difference must be attributed to the latter having undergone the action of fire, which, it is known, has the effeet of eonverting feeulas into gum or dextrine. The latter, as we have said, is not eolored by the vapor of iodine; and if genuine and factitious tapioca and sago take a yellowish tint, it is because the whole of the fceulent matter is not eonverted into dextrine.

The coloration of feculas is due to the property which these bodies possess of absorbing both the vapor of iodine and the vapor of water. Experiment has proved that feculas are eolored by iodine only when they are damp. Indeed, if, before exposing them to the action of iodine, they be dried at 212° F., they are not colored by a eontact of 24 hours; provided, however, that they be not placed in such a situation as to attract moisture. Although in this case the feculas remain uncolored, they have, however, absorbed iodine; for, if they be put in contact with water, they are colored in the same manner as they would have been had they been in their ordinary state.

This mode of testing has been proposed not only for detecting the presence of potato

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is under the form of irregular clots, opaque, or of a dead white, very hard, always composed of small agglomerated grains; whilst factitious tapioca is in almost regular fragments, less white, less hard to bite, but more brilliant than those of genuine tapioea, presenting a homogenous structure, and not the granular structure of genuine tapioca. It is, therefore, very easy to distinguish these two substances by their appearanee, when they have once been carefully examined.

I exposed to the action of the vapor of iodine the substances mentioned in the above Table, and, after 24 hours' contaet, I obtained the eoloration therein indicated.

fecula in farinas, but also for ascertaining the proportions in which the mixture has been made. From what we have just said, it is evident that this process cannot be employed, since a little more or less moisture in the farinas may cause a variation in the intensity of the color, which they take when exposed to the vapor of iodine.

POISONING BY LEAD.*

BY MM. FLANDIN AND DANGER.

In a memoir read before the Academy of Sciences, MM. Flandin and Danger arrive at the following conclusions :—

1. There exists no lead in the human body in the normal state.

2. The symptoms, and especially the cardavaric lesions, which poisoning by lead produces, are quite characteristic.

3. If death has immediately followed the swallowing of a poison, lead is formed in the body as surely as arsenic, antimony, and copper are found in it. The metal should be particularly sought for in the digestive canal, the liver, the spleen, the renal apparatus, and the lungs. It is not detected in the blood, the heart, the brain, the muscles, nor in the bones. The proportion to which we can attain, being in the order of 1·001·000, it is sufficient to operate on from 48 to 60 grammes of liver to detect manifest traces of the poisonous compound.

4. The process which has led us most surely to such results, is, with a very slight modification, that which we proposed for the detection of arsenic, antimony, and copper. It consists in carbonising the animal matters by means of sulphuric acid, heating the carbon to redness, treating it by hydrochloric acid, then by water, in order to operate on the liquid, the reactions proper for characterising lead.

5. Contrary to copper, the lead absorbed is eliminated by the renal secretion.

6. The absorption of poisons is particularly operated by the vena porta, which explains why they are found in such large quantity, and some of them almost exclusively in the liver.

7. When the poisoning has been produced by the skin, the absorption or transmission of the poisonous substances is made principally by means of the superficial subcutaneous and submucous blood-vessels and lymphatics ; having passed in particular into the digestive tube, by a kind of perceptible perspiration the poison is rejected by the vomitings and by the stools, or else it is taken up by the system from the vena porta, absolutely as if it had been introduced by the stomach. The progress which the poison follows in the absorbent media, after it has been applied under the skin, is perhaps an indication to be kept in view for prescribing to workmen, who work in lead and copper, prophylactic remedies of a particular order—acid, saponaceous or sulphurous lotions, and baths.

8. In cases of medico-legal investigations, certain organs must exclusively be operated on, and not all the parts of the body indifferently ; the liver should be selected in preference. In ordinary cases, the tenth part of this organ (about 500 grammes) is sufficient.

* *Comptes Rendus.*

REPORT ON THE OPIUM OF ALGIERS.*

BY MM. DE MIRBEL, BOUSSINGAULT, AND PAYEN.

In order that we might be able to verify some doubts which have arisen concerning the proportion of morphia yielded by the opium gathered in Algiers, M. Simon, the Minister of War, sent us a detailed memoir containing a description of the analytical processes followed at the Pharmacie Centrale of Algiers, by M. Herpin, Chief Pharmacier.

The products obtained in two comparative analyses of Algerian and Oriental opium reached us by the same means.

We hastened to examine these documents and samples.

The means employed are clearly described, and are well adapted for the comparative examination in question ; however, the opium taken for comparison, said to be from Constantinople, and obtained from the medicine depôts for the Military Hospital at Marseilles, having given a smaller proportion of morphia than the best qualities of Smyrna and India, it was of little interest to compare the quantities of the two products, whilst it might be useful to verify the real weight and the purity of the morphia extracted from the Algerian opium. The flask containing it, which arrived in good condition and carefully sealed, enabled us to make the verifications.

We regretted not finding in the memoir any indication of the hygroscopic water which the opium lost by desiccation *in vacuo*, and which is necessary for establishing an exact relation between the results obtained at the Pharmacie Centrale with the opium collected by M. Simon, and those of our analyses of the sample arising from the crop of M. Hardy.

* *Comptes Rendus*, No. 7.

The two products of morphia which we have just received could not be completely pure, although they were crystallised; for one of them had a fawn color, and the other a yellowish grey tint. Some agglomerations appeared to be formed by the interposition of a foreign matter between the crystals, as may be judged by examining the still sealed samples of morphia extracted from the Oriental opium.

We weighed with great care all the morphia extracted from M. Simon's opium. It amounted to 3,520 milligrammes, which, dried *in vacuo*, were reduced to 3,501; bruised and washed until exhausted in ether, then with slightly alcoholised water, it was afterwards dissolved in boiling alcohol; the solution, filtered, gave the white and pure crystals which we here present. The mother liquor, evaporated, allowed to crystallise out a small quantity of slightly colored morphia, then a last portion of a slight fawn color (*fauve*).

The foreign substances eliminated were composed—

	Milligr.
1st. Of the portion removed by ether, of a fawn color, of resinoïd aspect..	65
2nd. Of the portion dissolved in the alcoholised water, of a yellowish color	49
3rd. Of insoluble bodies, containing carbonaceous particles, &c. weighing	14
	128

By subtracting these 128 milligrammes from the 3,501, 3,373 milligrammes remain: whence, deducting also the foreign colored substances deposited by the evaporation of the mother liquors, removed by the purification of the two crystallisations, which weighed 46 milligrammes, a net weight of 3,327 milligrammes is obtained—a weight little exceeding that of pure morphia really obtained, and which was equal to 3,225 milligrammes. This latter quantity may, indeed, represent the morphia extracted in similar conditions to those in which we were placed in analysing the opium of Mr. Hardy.

If we admit that the sample analysed by M. Herpin contained the same proportion of hygroscopic water, and weighed 30 grammes, as the memoir and the label of the flask indicate, we shall have the ratio of—

30 : 3·225 : : 100 : 10·75,

or very nearly the same richness in morphia as in the produce of the cultures and crop of Mr. Hardy.

This would be one more reason for hoping to obtain from Algiers opium of more uniform quality than all those of commerce, and of equal richness in morphia to that of the finest varieties of opium of Smyrna and India, collected in tears, and free from adulteration.

We might, doubtless, reckon on a result as important, in the interest of civil and military medicine, if the experiments be continued with the same enlightened care as Mr. Hardy and M. Simon; perhaps rather more would be obtained, if we combined all the most favorable conditions which they themselves have indicated.

MARRUBIUM.

To the Editors of The Chemist.

Gentlemen,

The value of Marrubium (*vulgare*, Horehound,) in some cases of pulmonary disease has not been overlooked by old writers; nevertheless, it has been discarded very unjustly from the Pharmacopœia, while other substances of no utility, or at least of doubtful efficacy, have been retained and introduced. In the rural districts the horehound has long been a popular remedy for coughs; and whenever the belief in any herb is found general, there are good grounds for presuming it possesses virtue. I have for many years been in the habit of employing the horehound, in the subjoined form, in cases of troublesome chronic cough, particularly in that species which is found so frequently after attacks of influenza and other severe forms of cold, and have invariably found it has restored the tone of the stomach, and subdued irritation, after other more valued remedies have been employed in vain. You may, therefore, probably think it of sufficient value for your columns.

I remain, Gentlemen,
Your obedient Servant,
W. Hamilton Kittoe, M.D.

25, Thayer-street, Manchester-square,
April 16, 1844.

℞—Decoctum Marrubium. . . ℥ vss.
Lupuline . . . . . iij. gr.
Acid. Hydrocyan, L. P. ℥i.
Syrup. Papaveris . . . . ℥iij.

Misturæ sumat coch., ampl. i. vel ij. ter. in die.

The decoction is prepared by boiling four ounces of the recent plant in a pint-and-a-half of spring water, till reduced to half the quantity.

CHALYBEATE WINE.*

BY M. E. SOUBEIRAN.

In acting with wine on iron filings, the quantity of iron which enters into solution is in proportion to the quantity of acid principles which the wine contains, and, for that

* *Journal de Pharmacie*, March, 1844.

reason, is essentially variable. Again: if the formula given by Parmentier, and adopted in many Pharmacopœias, be followed, which consists in adding to white wine tincture of tartrate of iron, the composition of the chalybeate wine is still more variable, since this tincture never contains uniform quantities of iron; besides, we have a medicine which does not resemble, in composition, that furnished by the direct action of the wine on the metal. By making use of the following formula, this inconvenience is avoided, at the same time retaining the advantage of being able to prepare the chalybeate wine at the time it is required, and in as small a quantity as is wished:—

Tartrate of protoxide of iron...	1 part.
Tartaric acid.....	1 ,,
White wine.....	1,000 ,,

The tartrate and the tartaric acid are triturated in a porcelain or glass mortar, the white wine is added, and it is filtered, if necessary.

M. Beral has recommended, in order to avoid the coloration of the wine by the iron, first to agitate the wine with a little hydrated peroxide of iron, to filter, then to allow the filtered wine to react on the iron filings. The effect indicated by M. Reral is correct; but, by operating with white Bordeaux wine, as I did, the difference in the coloration of the wine, whether peroxide of iron were used or not, is so trifling that it may be neglected.

The preparation of tartrate of iron is very simple: it is necessary to decompose one equivalent of protosulphate of iron by an equivalent of neutral tartrate of potassa, to promptly wash the precipitate with distilled water, to press it powerfully in a cloth, and to dry it on a sand-bath.

A NEW AND VERY EFFICACIOUS ASTRINGENT TOPICAL REMEDY.

BY DR. PUTEGNAT.*

This remedy, new in human therapeutics, is that of Knaup, which is regarded by many veterinarians as a sovereign remedy against the recent contusions of horses. Dr. Putégnat has employed it with success in sprains; in contusions, with or without wound; in a fracture, with enormous tumefaction, and vast effusion of blood; in a case of considerable swelling consecutive to laxation; in erysepalous of the face; in two cases of erysepalous, following *mouchetures* practised on œdematous limbs; in a case of incipient whitlow, and in a varicose ulcer.

The following is its exact composition:—

	Parts.
Sulphates of iron, alumina, and potassa	*a a* 500
Hydrochlorate of ammonia....	*a a* 30
Oxide of copper	
Sulphate of zinc	

Mix the whole, and fuse at a gentle heat.

Dissolve in 1,000 parts of tepid water a piece of this matter of the size of a nut, and soak in the liquor the compresses with which the diseased parts are to be covered.

IV. REVIEWS AND NOTICES OF BOOKS.

THE CHEMICAL AND PHYSIOLOGICAL BALANCE OF ORGANIC NATURE: An Essay, by M. J. Dumas and J. B. Boussingault, Members of the Institute of France. London: Bailliére.

The names of the authors of this work are a sufficient guarantee of its title to consideration. A portion of its contents has appeared at various times in The Chemist.

We have only to observe, that no one engaged in agricultural pursuits, or in the rearing of animals, should be without this little book.

We are obliged to content ourselves with giving the following extract:—

"*Source of the Azote of Plants.*—Whilst in the preceding pages we have spoken continually of certain plants taking azote from the air, and of others deriving it from manures, there is no positive mention of ammoniacal compounds having any essential part to play in this phenomenon.

"The reason is simple: it is, that though we saw ammoniacal compounds play the part of powerful manures, it was impossible to affirm that the azote of the air takes this form before becoming fixed in the substance of plants. In presence of the Academy we should, therefore, have had nothing to offer beyond an opinion upon the subject. But if we divide the question, it becomes perfectly clear.

"M. Boussingault shows us that certain

* *Gazette des Hôpitaux.*

plants fix the azote of the air. It is not known whether this azote passes into the state of ammonia before becoming fixed; ulterior experiments can alone determine the point.

"What renders it probable that it does, is the fact that ammoniacal salts certainly play an important part in the manures of which they form a constituent. Let us see, then, to whom belongs the discovery of this duty, or, at all events, who first endeavored to give a practical demonstration of the fact.

"In a journey which he took into Alsace, in 1836, in the course of which he visited the beautiful manufactory of Bouxwiller, in company with M. Péligot, M. Dumas received the following communication from M. Schattenman:—

"'Ammoniacal salts form very energetic manures. In Switzerland it is the practice to drench the dungheaps, and to saturate the liquor obtained with sulphate of iron or sulphuric acid, by which means a liquid manure of great potency is obtained. The sulphate of ammonia in solution, distributed over a meadow with a watering-pot, enables us to repeat the celebrated experiment of Franklin.'

"Since this time, M. Dumas has always cited M. Schattenman in his Course, as having discovered the part which ammonia plays in vegetation. But here is an abstract of a letter from this ingenious manufacturer on the subject:—

"'I esteem it a proof of your kindness that you do me the honor to quote me upon various occasions in treating of the action of ammonia upon vegetation.

"'The treatment of manures is still greatly neglected in France, and even in Alsace, where agriculture is nevertheless very far advanced. For a long time past the urine of the stable has been made use of in Switzerland; there they are in the habit of exhausting dunghills with water and collecting the liquor in ditches, in which, after fermentation, the ammonia is saturated and converted into sulphate of ammonia by means of sulphate of iron, sulphate of lime, or oil of vitriol. The liquor thus prepared, distributed over the fields, produces a luxuriant vegetation, which must be mainly ascribed to the sulphate of ammonia, which is not volatile like the carbonate, and is not dissipated and lost to the proprietor by the action of heat. Dung, like urine, contains ammonia, which it is of import to preserve, but which, under the usual modes of procedure, is generally lost.

"'Horse-dung is held to be vastly inferior to that of horned cattle; but this appears to be entirely owing to the method of treating it, which in Alsace, Lorraine, and throughout France generally, consists sometimes in throwing it into a pit, where it is liable to be drowned with water, sometimes in heaping it up into a hillock, either leaving it to dry, or watering it insufficiently. The prejudiced notion that horse-dung does not make good manure unless it be turned and mixed, leads to its being stirred once or twice at least. Now, the dung which is immersed in water does not ferment, and the straw does not undergo decomposition; and that, on the contrary, which is heaped up lightly, and is not sufficiently watered, heats up to the point that it moulds; the ammonia which has been formed is dissipated, and the most energetic portion of the manure is lost. The manure that remains is, in fact, light and little substantial, and vastly inferior to that derived from the dung of oxen and kine, which, as being naturally moist and fat, is little disposed to heat and perish.

"'For my own part, I have always treated horse-dung with perfect success, upon a plan altogether different from that which is generally practised. I had a square shallow pit dug, 400 metres superficial measure (about 437½ yards), but divided into two compartments of 200 metres each. This pit is an inclined plane, sloping towards the middle, so that the liquid which oozes from the dunghill collects in a reservoir there, which reservoir is furnished with a pump, for the purpose of returning the drainings as often as may be desired upon the dungheap. By this arrangement I do not lose a drop of the saturated liquor that distils from the dunghill. This liquor, in fact, is at length entirely absorbed by the manure when it is ready for carting, unless it has been reserved for the purpose of being employed by itself.

"'The two compartments are alternately piled with the dung from the stables, which is laid from three to four or five yards thick over the whole surface of the square, trodden down by the feet of the men who fetch it, and abundantly watered by the pumps.

"'I thus obtain sufficient solidity and moistness—two conditions which I regard as necessary to keep under or subdue the violent fermentation to which stable-dung is subject, and which causes the dissipation of its most active parts. I add to the saturated liquor sulphate of iron in solution, or I scatter over the dung-heap a quantity of sulphate of lime or plaster in powder, with a view of converting into a sulphate the ammonia which is evolved, and which would be dissipated and lost to me if not thus fixed. By these simple and little costly means, in the course of from two to three months I obtain a large quantity of manure perfectly made, as fat and pasty as the dung of neat cattle.

and of great strength, a fact which is abundantly manifested in the remarkable crops I have grown on my fields and meadows for a number of years past.

" ' Horse-dung, piled up, absorbs a very considerable quantity of water, which is explained both by its natural dryness, and by the heat it engenders, and the evaporation to which this gives rise. I am convinced that sufficient importance is not attached to this evaporation, and that stable-dung does not receive from the majority of our farmers nearly the quantity of water it requires.

" ' Urine, and the drainings from heaps of fermented manure, the ammonia of which has been converted into a sulphate and retained, if distributed over grass-fields and meadows by a watering cart, produces great luxuriance of vegetation, so that a name written or a figure described in watering a meadow is very distinguishable by the superior growth, *just as it was easy to form such figures by strewing plaster over the surface of the clover-fields in America, when there was an anxiety to extend the use of gypsum in that country.* Ammonia is an essential part of manure, for whatever purpose employed; and as my process tends to preserve the ammonia, and to prevent its loss by evaporation when the manure is spread, it is obvious that this manure must have a very superior effect.

" ' I do not imagine that I have made any discovery here; the practice of saturating the urine and drainings of dunghills, and of watering meadows with the liquor during damp weather, in the spring as well as after each successive cutting, is old in Switzerland. I only sought to know the nature of the action of sulphate of iron upon fermented urine, and of the powerful effect of the fluid to which it was added upon vegetation. I was naturally led to conclude, that the ammonia engendered, by decomposing the sulphate of iron, is itself converted into a sulphate, which, not being volatile, is not dissipated, and so becomes the principal cause of the great influence exerted by the prepared liquor upon vegetation. I was also led to perceive that horse-dung by entering into too violent fermentation, by overheating, must cause a dissipation of its volatile ammoniacal parts, and I therefore bethought me of a means of mastering this fermentation as well as of fixing the ammonia.

" ' I have made these principles known upon all occasions. Various proprietors, fond of agriculture, have made use of sulphate of iron to saturate the drainings of their dung-hills, without attaching much importance to the result, with the exception of Baron de Gail, a landed proprietor at Mülhausen, who has made use of the sulphate of iron and plaster for several years in this direction, and who loudly vaunts the good effects he has obtained from the practice.'

" The preceding letter is accompanied with a document dated 12th July, 1835, which proves that the facts it contains were at that time publicly announced at the Agricultural Meeting of the Lower Rhine."—Pp. 133—140.

THE FALLACIES OF OUR OWN TIME. By Oliver Byrne, late Professor of Mathematics, College for Civil Engineers; and Professor John Byrne, Norfolk, Virginia, United States. First Part: Fallacy of Phrenology. London: Sherwood and Co.

The Professors Byrne are publishing a series of *exposés* of the "Fallacies commingled with our Sciences, Laws, Religions, Education, and Conventional Usages. To consist of Twelve Parts; each Part will be complete in itself."

The Part before us displays the fallacy of the so-called *science* of Phrenology, and our mathematical authors have shown its fallacious nature with professional exactitude. We have not either time or space for a lengthy review of this work; but we can recommend it to the perusal of our readers, in the full confidence that they will be gratified by the careful, masterly, scientific, yet not tedious manner in which these gentlemen have executed their task.

We hope to be able to devote more space and time to some future Parts.

We are glad to find that our correspondent, James Sheridan Muspratt, of Seaforth Hall, Liverpool, has, through the instrumentality of Professor Liebig, obtained his degree at the University of Giessen, for an original paper on the Sulphates.

BOOKS RECEIVED.

"A Brief Description of the Characters of Minerals: forming a Familiar Introduction to the Science of Mineralogy." By Edward J. Chapman, author of "Practical Mineralogy." London: H. Baillière, 219, Regent-street.

[This excellent little work will be noticed in our next.]

"Watkins and Hill's Descriptive Catalogue of Electrical Instruments;" illustrated by 98 engraved figures.

"Watkins and Hill's Descriptive Catalogue of Voltaïe and Thermo-electrical Instruments;" illustrated by 78 engraved figures. London: Watkins and Hill, 5, Charing Cross.

[Every chemist and electrician should purchase these useful and highly creditable catalogues. Evidently, great labor and attention have attended their production.]

TO CORRESPONDENTS.

"One of our Oldest Subscribers," Hereford.—We will endeavor to comply with your request.

"M.P.S.G.B.," should favor us with his name.

"¶."—Let us have the means of writing to you.

We are too much engaged in professional pursuits to attend to the Pharmaceutical Society this month.

To suit the convenience of such of our readers as may wish for answers to questions sooner than can be obtained through the "Notices" in our Journal, we have determined on the following. Letters sent *before* the 10th of each month will be answered on that day by private letter; those which are sent after that time, on the 20th; after the 20th, letters will be answered in the Monthly Number, or privately on the 1st. Correspondents must send their names and addresses; or initials, and the post-offices of their districts, will do.

SUMMARY OF METEOROLOGICAL OBSERVATIONS MADE AT OTLEY, YORKSHIRE, IN MARCH, 1844.

BY E. THOMPSON.

BAROMETER.

Monthly mean	29·59
Mean at 9 a.m.	29·58
,, at 3 p.m.	29·57
,, at 9 p.m.	29·62
Maximum on 29th	30·33
Minimum on 2nd	28·98
Range	1·35

THERMOMETER.

Monthly mean	37°
Mean of maxima	43
,, minima	32
Maximum on 27th	56
Minimum on 6th	26
Range	28

WIND.

Days.		Days.
N. 1		S. 0
N. E. 0		S. W. 2
E. 1		W. 10
S. E. 1		N. W. 7

RAIN.

2·56 inches.

WEATHER.

	Days.		Days.
Clear	12	Snow	7
Cloudy	3	Frost	16
Overcast	3	Hoar frost	1
Showers	5	Mist	0
Rain	6	Hail	1

GENERAL REMARKS, MARCH, 1844.

Severe wintry weather has prevailed during the entire month. There have been 16 frosty nights more than occur on an average of winters in general. Snow has frequently fallen, which has soon dissolved in low situations, but in a mountainous district a little to the north of the town the roads were rendered for some time impassable. Pertussis, a very common disease at the beginning of the month, declined in violence and frequency towards the latter end.

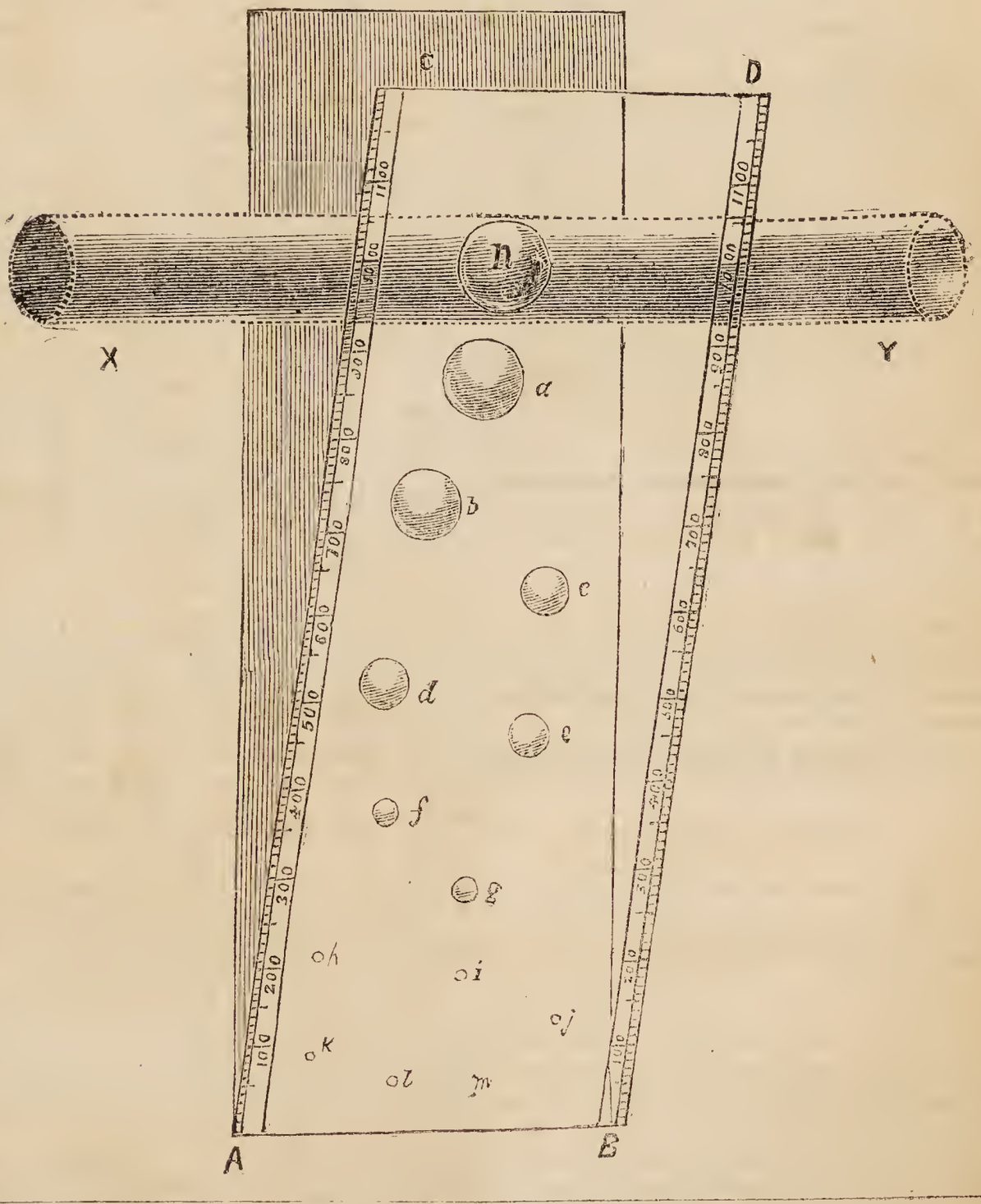
Nota Bene.—*All Communications, Books for Review, and Substances to be Analysed, must be addressed "To the Editors of the Chemist, 310, Strand, London." Communications must be prepaid, and sent before the 15th of each month; Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

A SIMPLE METHOD OF FINDING THE WEIGHT OF ANY VERY MINUTE METALLIC GLOBULES WITHOUT A BALANCE.*

INVENTED BY OLIVER BYRNE, LATE PROFESSOR OF MATHEMATICS, COLLEGE FOR CIVIL ENGINEERS; AUTHOR OF "THE DOCTRINE OF PROPORTION," &c., &c.



* Written for Dr. James Sheridan Muspratt's Translation of Plattner's excellent Work on the Blow-pipe. Communicated to THE CHEMIST by the Author.

Let A B C D, and A B F G, be two pieces of very finely-polished plate glass, joined together at A B, forming with each other a very acute angle.

The figure is distorted, and the necessary mounting omitted, for the purpose of exhibiting the parts more distinctly. A C and B D represent scales of equal parts, of a greater or less degree of fineness, according to the exactness required; they may be drawn on paper, and pasted to the glass. X Y is a cylindrical piece of wire of any convenient length, or of any sort of metal, placed between the plates of glass, near the top, parallel to A B: the planes are tangent planes to the cylindrical wire. This wire must have a fixed position while experimenting. The diameter of this cylinder can be calculated with very great accuracy, by weighing a pound, or a half-pound, of the wire from which it is cut; this weight divided by the length of X Y will give its weight, and, from knowing the specific gravity of the metal, the diameter of the wire can be thus accurately determined; this diameter will be the diameter of the globe n, the greatest possible that can be made out of the cylinder X Y. The solidity of this globe can be also readily ascertained, and would stand in the same position, subtending the same acute angle, if the cylinder were removed.

Suppose the *inch* and the *ounce* to be the units of measure and weight respectively, L the length of a piece of wire weighing q ounces, from which X Y $= l$ is supposed to be taken, then $\frac{q\,l}{L}$ = the weight of X Y.

Then say as, $S : \frac{q\,l}{L} :: c : \frac{c\,q\,l}{L\,S}$ = the solidity of X Y in cubic inches, S being the specific gravity of the metal, or the numbers of ounces in 1728 $(= c)$ cubic inches;—

$\therefore \frac{c\,q}{S\,l}$ = area of the circular cross section of X Y.

$\pi = 3{\cdot}14159$, &c.

$\sqrt{\frac{4\,q\,c}{\pi\,L\,S}}$ = the diameter of this section, or the globe n, the solidity of which $= \frac{\pi}{6}$

$$\sqrt{\frac{64\,q^3\,c^3}{\pi^3 L^3 S^3}} = \tfrac{4}{3}\sqrt{\frac{q^3\,c^3}{\pi^3 L^3 S^3}} = \sqrt{\frac{16\,q^3\,c^3}{9\,\pi\,L^3 S^3}}$$

an expression well adapted to logarithmic computation, which is independent of the length of X Y.

Example.—Suppose a piece of copper wire 376·5 inches long, to weigh 5 ounces, what is its diameter? And what is the solidity of the greatest globe that can be taken out of its cross section?

Let L = 376·5, S = 9008, $c = 1728$, $q = 5$, and $\pi = 3{\cdot}14159$, &c.

Then log. 4.	= 0·6020600
log. q.	= 0·6989700
log. c.	= 3·2375437
Sub. log. π	= 9·5028501
Sub. log. L	= 7·4242350
Sub. log. S	= 6·0453716
Reject 30·. . .	27·5110304
	2) 3·5110304
The diameter of the wire. . . . = ·0569528 =	2·7555152
	3
	4·2665456
Log. $\frac{\pi}{6}$ = ...	1·7189986
Log. ·00009672622 =	5·9855442

So that the diameter and solidity of a globe, placed in the position of any wire X Y, can be determined to any degree of accuracy required. If the part X Y be taken from such a wire as the one given in the example, the diameter would be ·0569528 inches, and the solidity of n, ·00009672622 cubic inches. The solidity of any other globule, a, b, c, or d, &c., suspended between the planes of glass, can be readily found, from knowing the distance of its centre from the line A B, where the planes meet; and the distance of the axis of the cylinder from the same line. These distances may be measured in a slant line by the scales A C, B D, and will answer as well as the perpendicular distances from the axis and centre. If very great accuracy be required, two distances are necessary—the one above, and the other below the globule: for instance, let us take the globule d, the distance of its lower limb from A B is 61, according to the rough design of our wood-cut, and the distance of the upper limb is 69; therefore its centre may be said to be $\frac{61 + 69}{2} = 65$ parts from the line A B. It is convenient, but not necessary, to have the wire X Y so placed, that the distance of its axis from A B may correspond with 10, 100, 1000, &c., on the scales A C, B D.

Suppose the wire n to be so placed that $s'\,t'$ reads on the scale A C and B D, referring to the first figure at 1002, and $w'\,v'$ to read 998; then $\frac{1002 + 998}{2} = 1000$, the best position for the wire which keeps the planes apart. Let $m'\,n'$ be at 645, and $p'\,q'$ at 643, then the globule may be said to stand at $\frac{645 + 643}{2} = 644$.

Indeed, if the globules were read off all above, or all below, it would answer the same purpose, observing to keep the lines $s' t'$, $m' n'$, or $w' v'$, $p' q'$, &c., parallel.

Then $1000^3 : 644^3 :: S : S^4$; S and S^4 being the solid contents of n and d respectively.

$$\therefore S^4 = \frac{644^3\, S}{1000000000}$$

$\therefore 1000^3 : 644^3 :: W : W^4$; W and W^4 being the weights of n and d respectively.

$$\text{Hence } W^4 = \frac{644^3\, W}{1000000000}.$$

The weights and solidities, or volumes of the small globules a, b, c, d, e, f, g, h, i, &c., supposing them to stand at 947, 895, 763, 644, 602, 533, &c., respectively, will be in like manner expressed by—

$$a\text{—}W^1 = \frac{947^3\, W}{1000^3}; \quad S^1 = \frac{947^3\, S}{1000^3}.$$

$$b\text{—}W^2 = \frac{895^3\, W}{1000^3}; \quad S^2 = \frac{895^3\, S}{1000^3}.$$

$$c\text{—}W^3 = \frac{763^3\, W}{1000^3}; \quad S^3 = \frac{763^3\, S}{1000^3}.$$

$$d\text{—}W^4 = \frac{644^3\, W}{1000^3}; \quad S^4 = \frac{644^3\, S}{1000^3}.$$

$$e\text{—}W^5 = \frac{602^3\, W}{1000^3}; \quad S^5 = \frac{602^3\, S}{1000^3}.$$

&c. &c.

$$\therefore W^1 + W^2 + W^3 + W^4 + \&c., = W\left\{\frac{947^3 + 895^3 + 763^3 + 644^3 + \&c.}{1000000000}\right\};$$

$$\text{And } S^1 + S^2 + S^3 + S^4 + \&c., = S\left\{\frac{947^3 + 895^3 + 763^3 + 644^3 + \&c.}{1000000000}\right\}.$$

The co-efficient, $\left\{\frac{947^3 + 895^3 + 763^3 + 644^3 + \&c.,}{1000000000}\right\}$ or similar ones, can be determined with great ease by a table of the cubes of numbers; in fact, they may be ascertained by addition. If this co-efficient $= f$, $W^1 + W^2 + W^3 + W^4 + \&c., = fw$.

$$\therefore W = \frac{W^1 + W^2 + W^3 + W^4 + \&c.}{f}.$$

It is evident, if the weights W^1, W^2, W^3, &c., of a great number of globules, a, b, c, d, &c., of any sort of metal, be taken together with a very fine balance, and the co-efficient f, determined by a table of cubes, the weight W, of the globe n, can be determined with the greatest possible accuracy, no matter what the specific gravity of the globules may be.

Thus, having found the volume and weight of n—and this may be done to any degree of accuracy—the weight and volume of any other globule or number of globules may be at at once determined from—

$$W^1 + W^2 + W^3 + W^4 + \&c. = W\left\{\frac{947^3 + 895^3 + 763^3 + \&c.}{1000000000}\right\} = wf.$$

$S^1 + S^2 + S^3 + S^4 + \&c. = sf$; or,

$\text{Log.}\,(W^1 + W^2 + W^3 + \&c.) = \log. w + \log. f.$ $\quad \text{Log.}\,(S^1 + S^2 + S^3 + \&c.) = \log. s + \log. f.$

It may be remarked that a detached scale of box or ivory will answer the same purpose as the attached scales A C, B D.

CRITICAL OBSERVATIONS ON THE PHENOMENA OF RESPIRATION.*

BY M. GAY-LUSSAC.

Two principal theories have been proposed relative to the chemical phenomena of respiration.

In the one, long adopted by chemists and physiologists, the formation of carbonic acid and water, as well as the production of nitrogen, take place in the lungs themselves, on the contact of the oxygen of the air with the capillary blood vessels.

In the other theory, oxygen does not act immediately in the lungs on the blood,

* *Comptes Rendus*, No. 14.

it is simply absorbed; and the chemical phenomena to which it may give rise take place out of the lungs in the circulation, and it is only at the return of the blood to the lungs that it pours in the products of oxidation.

This latter theory, which was long foreseen, confirmed, and shaken in turns by some opposed facts, has finally become current in science, since the last work of M. Magnus on Respiration,* a delicate and difficult work, the object of which was, by proving the presence of carbonic acid, oxygen, and nitrogen in the blood, to give the new theory of respiration a solid basis, which it had previously wanted. Judging from the assent of some eminent chemists, and from the silence of criticism, the investigations of M. Magnus seem to have fixed the opinions concerning the chemical phenomena of respiration; and it is not without diffidence that, impressed by the doubts which have arisen in my mind, I raise a discussion which, however, has no motive but the interest of truth.

M. Magnus first sought to prove that human venous blood contains carbonic acid. For this purpose he passed through blood a current of hydrogen, which, after having been dried, yielded the carbonic acid with which it was charged to potassa in Liebig's bulbous apparatus. Experiments, each of which lasted six hours, gave him the following results:—

Human venous Blood.	Carbonic Acid.	Or per cent. of Blood.	Carbonic Acid
cc.	*cc.*	*cc.*	*cc.*
66·8	16·6	100	24·8
59·8	12·8	100	21·4
62·6	22·2	100	35·2

After 24 hours, at the end of which time the blood still had no odor:—

Human venous Blood.	Carbonic Acid.	Or per cent. of Blood.	Carbonic Acid.
cc.	*cc.*	*cc.*	*cc.*
62·8	24·9	100	37·2
59·8	23·9	100	40·0
62·6	34·0	100	54·0

By replacing the hydrogen by air, oxygen, or nitrogen, the results remained the same.

I will not stop to discuss these results, which prove besides that the blood contains much carbonic acid; I will only remark that they are not complete, for it would be necessary to submit to the same trials arterial blood, which also contains carbonic acid. It would also be necessary to determine the relative quantities of oxygen and nitrogen contained in each kind of blood.

But this important deficiency having been made up in another series of experiments of M. Magnus, by subjecting blood to the vacuum produced by the pneumatic machine, we will particularly direct our attention to the various results which he obtained in these new circumstances. We must take them as published, and refer for the details of experiment to his memoir. The following Table contains all these results; they are only arranged in a different order. We have collected together the results which relate to arterial blood, and, separately from these, the results obtained with venous blood. Finally, that all the experiments may inspire the same confidence, and in order to diminish the differences which might exist between one experiment and another, we have taken the average of the results for each kind of blood, without regarding the different nature of the animals by which it was furnished.

ARTERIAL BLOOD.

Source of the Blood.	Volume of Blood.	Carbonic Acid.	Oxygen.	Nitrogen.
	cc.	*cc.*	*cc.*	*cc.*
Arterial blood of a horse, A.....	125	.5·4	1·9	2·5
Natural blood of a very old but healthy horse, B.....	130	10·7	4·1	1·5
The same blood, B.....	122	7·0	2·2	1·0
Arterial blood of a cow, C.....	123	9·4	3·5	1·6
The same blood, C.....	108	7·0	3·0	2·6
	608	39·5	14·7	9·2
Or, by reducing the volume of blood to 100	100	6·4967	2·4178	1.5131

* *Annales de Chimie et de Physique*, tom. lxv., p. 169.

Venous Blood.

Source of the Blood.	Volume of Blood.	Carbonic Acid.	Oxygen.	Nitrogen.
	cc.	*cc.*	*cc.*	*cc.*
Venous blood of the same horse, A.....	205	8·8	2·3	1·1
The same venous blood, A.....	195	10·0	2·5	1·7
Venous blood of the same old horse, B, collected three days after.....	170	12·4	2·5	4·0
Venous blood of the same cow, C, collected four days after.....	153	10·2	1·8	1·3
The same venous blood.....	140	6·1	1·0	0·6
	863	47·5	10·1	8·7
Or, by reducing to 100.....	100	5·5041	1·1703	1·0081

Before interpreting the results contained in this Table, it is necessary to explain more clearly than we have done in what the new theory consists.

It admits that, in the act of respiration, the oxygen of the air is absorbed by the arterial blood in the lungs; that it is afterwards carried into the torrent of the circulation; that, in the passage, and by the *secreting* action of the capillaries, a certain quantity is combined, partly with carbon, to form carbonic acid, which remains in solution in the blood; and partly with hydrogen to form water. The blood, thus charged with carbonic acid, and converted into venous blood, arrives in the lungs, where it abandons its carbonic acid—again acquires oxygen, and again becoming arterial blood, commences a new revolution.

Thus, M. Magnus should principally prove:—

1. That venous blood should contain carbonic acid; and in the case where the arterial blood also contains it, in greater quantity than the latter.

2. That the difference of the quantities of carbonic acid in each blood should satisfy the exigencies of respiration.

3. That the quantity of oxygen absorbed in the lungs by the arterial blood, and afterwards abandoned in its passage through the circulation, should likewise satisfy both the production of carbonic acid and that of the water, which always accompanies it in the act of respiration.

4. That venous blood should contain nitrogen, and more than arterial blood, in the case where the latter contains it also.

Let us see, then, whether these different conditions are satisfied by the experiments of M. Magnus.

The results contained in the last Table evidently prove that arterial and venous blood contain in solution carbonic acid, oxygen, and nitrogen. This is a fact acquired to science, if the experiments of M. Magnus are indisputable. But in examining the relative quantities of gas in each kind of blood, very manifest contradictions were soon discovered. Thus, whilst 100 parts in volume of arterial blood produced 6·4967 of carbonic acid, venous blood furnished only 5·5041. And yet the relative quantities of acid, in each blood, should evidently be in the contrary direction. Consequently, if there do not exist some unperceived error in the results of M. Magnus, if I myself have not made some mistake, this new theory of respiration should vanish with the essential basis of which it is thus deprived; for this theory requires that the venous blood should contain more carbonic acid than arterial blood, and the very experiments of M. Magnus depose to the contrary; arterial blood contains 18 per cent. more carbonic acid than venous blood does.

It is true that, by his mode of experimenting, which consisted, as we have said, in submitting the blood to the action of a vacuum, to disengage from it the gas which it contains, M. Magnus did not, perhaps, extract from the blood one-tenth part of the carbonic acid which it may contain, since, by passing hydrogen into venous blood, he obtained as much as 54 per cent. of carbonic acid. But it should not the less be admitted that the fractions of carbonic acid obtained by M. Magnus should be proportional to the absolute quantities contained in each kind of blood; and that if, *ipso facto*, they were not so, no other conclusion could be arrived at, than that the experiments of M. Magnus are quite incomplete, and that they cannot lend any support to the new theory of respiration.

The same difficulty as for carbonic acid presents itself with regard to nitrogen; arte-

rial blood should contain less than venous blood, and, according to the Table of results of M. Magnus, it contains one-half more. It is well known that nitrogen is produced in the act of respiration, and M. Despretz has proved even that its volume amounts to about one-fourth of that of the carbonic acid. Facts, then, would here be formally opposed to theory.

The proportions of oxygen alone proceed in a favorable direction for each kind of blood; for 100 parts of arterial blood gave 2·4178 of it, and venous blood only 1·1703, or above one-half less. But in presence of the negative results which we have noticed as regards carbonic acid and nitrogen, it may be asked, what value should rest on that concerning oxygen? We will accept it, however, and will examine the consequences.

It is at once evident, that since carbonic acid is produced during the act of respiration, at the expense of the oxygen absorbed by the blood, there should be a certain relation between the volumes of these two elastic fluids. If, for example, we knew only the relative volume of carbonic acid expired in a given time, we should know that the corresponding volume of oxygen absorbed should be at least equal to it; and this condition being thus established, it would be easy to ascertain if it were satisfied by the direct results of experiment. Unfortunately, those obtained by M. Magnus, on the quantity of carbonic acid contained in arterial and venous blood, weaken each other, and have absolutely no value.

In the absence of positive data, which should be afforded by the work under discussion, we will draw from other sources those which were quire, and we cannot do better than take the data adopted by M. Magnus. These data are:—

1st. That, according to Sir H. Davy, a man expires in one minute 13 cubic inches of carbonic acid.

2nd. That each pulsation of the heart furnishes one ounce of blood; and that, supposing there are 75 pulsations per minute, 75 ounces of blood, or 115·7 cubic inches, pass in the same space of time.

Consequently, since 115·7 cubic inches of blood contain 13 of carbonic acid, 100 of blood should contain 11·23, a quantity which blood might very well furnish; for M. Magnus admits, according to his experiments, that it contains more than 20 per cent.

Now, supposing that venous blood abandons 11·23 per cent. of its volume of carbonic acid, it is evident that, in order to produce it, arterial blood should contain at least an equal volume of oxygen, or 11·23.

Moreover, as in the act of respiration, of four parts of oxygen absorbed three are converted into carbonic acid and one into water, the blood should take in the lungs not only 11·23 of oxygen, but indeed $11{\cdot}23 + \frac{11{\cdot}23}{3} = 14{\cdot}97$, a quantity which is sixteen times more considerable than that (0·926) which pure water could take in the same circumstances, that is to say, in presence of atmospheric air, and which would amount to $14{\cdot}97 + \frac{14{\cdot}97}{21} = 71{\cdot}3$ if the blood were in contact, instead of air, with an atmosphere of oxygen.*

Finally, if it be admitted, with M. Magnus, that venous blood, on its arrival in the lungs, retains nearly half of the oxygen previously contained in arterial blood, the total quantity which the latter should contain on leaving the lungs would be—1st, 14·97 destined for forming carbonic acid and water; 2nd, $\frac{14{\cdot}97}{2}$ which remain in the venous blood, that is to say, in all, 22·45, which would suppose that, in contact with an atmosphere of oxygen, 100 of arterial blood might take $22{\cdot}45 \times \frac{100}{21} = 106{\cdot}9$ of gas, or more than its volume. Assuredly, such a solubility of oxygen in blood, twenty-four times greater than in water, is not impossible; but still it should be proved, or, at least, rendered probable. I agree, if it be wished, that the data which I have adopted after M. Magnus have not, perhaps, all the accuracy desirable; and that large concessions may be made with regard to them: but, even by altering them greatly, the objections derived from so extraordinary a solubility of oxygen in blood would, nevertheless, still have great force.

Here it is very necessary to be understood with respect to the idea which should be formed of the union of oxygen with the blood. Does it take place by virtue of the affinity which produces combinations? Is it simply by virtue of that which presides over solutions?

I have reasoned on the hypothesis of a simple solution. M. Magnus has also adopted it, and he could not do otherwise. This is evident as regards the carbonic acid and nitrogen; for, as these two gases must be disengaged from the blood in contact with air in the lungs, they must be retained by only a very feeble force, that which produces solutions.

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* I admit, from old observations which are common to myself and my illustrious friend, M. de Humboldt, that water which has been in contact with atmospheric air contains $\frac{1}{36}$ of its volume of air composed of $\frac{1}{5} = 0{\cdot}926$ of oxygen and $\frac{4}{5}$ of nitrogen; whence it is concluded, that 100 of water in contact with air would dissolve 1·41 of it, and with nitrogen 2·31.

As to the oxygen which, after having been absorbed by the blood, is disengaged from it only under the form of carbonic acid, it seems that M. Magnus should have been able to admit that it combines immediately and intimately with the blood; he would thus have eluded the difficulty we have mentioned of so great a solubility as that to which we have been led to satisfy the exigencies of theory. But this is why M. Magnus has not been able to have recourse to affinity for fixing the oxygen in the blood. It should, then, have been asked of him why oxygen, fixed in the blood by virtue of a chemical affinity, should not immediately have produced its final effect? Why its action should be divided into two, one in the lungs, and the other out of the lungs, in the capillaries, in order finally to produce carbonic acid and water? M. Magnus has comprehended a difficulty which would have had the result of falling into the old theory, and he could avoid it only by admitting that oxygen was absorbed by the blood only by a solvent power.

After this explanation, it will be well understood that all the gases which intervene in the phenomena of respiration, whether they be absorbed by the blood or disengaged from it, do but obey a simple force of solution, according to the laws established by Dalton.

With the view of elucidating the question under discussion, we will make a new application, with data partially different from those of which we have made use.

According to recent experiments of M. Bourgery, an adult man, respiring freely, introduces at each respiration a *demi-litro* (1 pint English) of air into the lungs. He performs 15 such inspirations in one minute, and, during the same space of time, the heart makes 60 pulsations. Let us still suppose, as before, that in one minute the heart throws 75 ounces of blood into the lungs, or, which comes to the same thing, 2 lit. ·3: finally, let us admit, with several observers, among whom I reckon myself, that the air expired from the lungs contains, on the average, 4 per cent. of its volume of carbonic acid, we shall be led to the conclusion that, since the volume of air introduced into the lungs in one minute is about 7 lit. ·5 (15 pints), whilst that of the blood which circulates through them in the same time is about 2 lit. ·3, or 3·26 times less. It is necessary, according to Dalton's law, and admitting that venous blood dissolves its own volume of carbonic acid, that, in order that it may give to the air in the lungs $\frac{4}{100}$ of its volume of carbonic acid, or in all 13, representing 13 of oxygen, it should contain $(1+3{\cdot}26) \times 4 =$ 17·0 per cent. of its own volume. This is the minimum of carbonic acid which venous blood should contain; and as arterial blood also contains it, this minimum would be the difference of the quantities of carbonic acid contained in each blood.

With regard to the oxygen necessary for forming the 13 per cent. of its volume of carbonic acid, which venous blood abandons to the air in the lungs, it is quite evident that arterial blood should absorb a similar volume for the production of carbonic acid, and even one-third more to furnish that of water. Now, the experiments of M. Magnus are far from satisfying these conditions.

M. Magnus seems to think that his theory is powerfully supported by the existence of carbonic acid in the blood. He would be right if venous blood contained decidedly more carbonic acid than arterial blood; but, as this result is far from proved, the presence of carbonic acid in the two bloods proves nothing more than a solubility for this gas, of which all theorists may avail themselves.

M. Magnus explains, to a great extent at least, the change of color of venous blood by the loss of carbonic acid which it suffers in the lungs. Two reasons prevent us from partaking in this opinion: the first, that it is not demonstrated that venous blood is freed from carbonic acid in the lungs; the second, that supposing that it were, the quantity of carbonic acid which it would retain, according to M. Magnus, should be so great in proportion to that which it gives up, that so remarkable a change of color could not be explained by so small a loss.

I do not wish to carry this discussion further. Incomplete as it is, it appears to me demonstrated that the theory of respiration maintained by M. Magnus rests on no solid basis; and that a new examination of the chemical phenomena of respiration has become necessary. I own that I should not have dared to undertake it alone; but I have the satisfaction of announcing that my illustrious *confrère*, M. Magendie, is kind enough to join me. From our united efforts, we hope at least, may arise some results contributing to a more perfect knowledge of the important function of respiration.

M. Magendie said that he had very recently analysed, comparatively, arterial and venous bloods, with relation to the carbonic acid which they contain. He found, in acting by displacement, 0 gr. ·066 of it in 100 grammes of arterial blood, and 0 gr. ·078 in a similar quantity of venous blood. This result comes in support of what M. Gay Lussac had said concerning the disagreement which exists between the experiments and the

theory of M. Magnus; for, if this cypher contradicts the fact advanced by that chemist as to the greater proportion of carbonic acid in arterial blood than in venous blood, it would furnish a proof in favor of his theory.

INVESTIGATIONS CONCERNING URANIUM.*

BY EUGENE PELIGOT.

The Memoir which I now submit to the judgment of the Academy forms the continuation of the investigations concerning uranium which I published in 1842. I demonstrated, in this first work, that uranium, which had heretofore been regarded as a simple body, is a metallic oxide; I separated from it the new metal, *uranium*. Calling the attention of chemists to the anomalous properties of this oxide, I thought that the most simple manner of determining them consists in attributing to this body two distinct parts: sometimes, as an energetic base, it unites with the acids, and gives rise to the green salts of protoxide of uranium; sometimes, acting as a simple or compound radical, it combines with chlorine sulphur and other metalloïds, in such a manner as to produce ternary compounds, endowed with all the properties of the chlorides, sulphurets and other binary compounds, formed by the union of the metals with the metalloïds. I gave to the protoxide of uranium, when it presents this radical character, the name of *uranyle*.

The properties of peroxide of uranium especially led me to regard this interpretation of facts as very probable and almost necessary. This oxide, whose composition is represented by the formula $U^2 O^3$, is the base of the yellow salts of uranium which contained the oxide and the acid combined, equivalent for equivalent; these salts are, consequently, tribasic according to their composition. Nevertheless, they present the whole of the physical and chemical characters which belong to neutral salts. This anomaly compels us to doubt the value and the universality of the laws relative to the composition of salts, or else to attribute to the oxide of uranium a peculiar composition. It appeared to me that this latter view was most correct; it leads to this oxide being regarded as the equivalent of an oxide with one atom of oxygen. In this hypothesis, it becomes $(U^2 O^2) O$, and it corresponds to the chloride of uranyle $(U^2 O^2) Cl$; the two atoms of oxygen of uranyle not contributing to its capacity of saturation, it forms neutral salts, by combining with one equivalent of acid.

My investigations concerning uranium, having met with an almost unanimous acquiescence, and, having been confirmed by the various investigations concerning this metal, which have since been made, I should perhaps have been right in regarding their results as acquired to science, if they had not been sharply criticised by Berzelius. In his annual Reports on the Progress of Chemistry, the illustrious perpetual secretary of the Academy of Sciences of Stockholm, throws some doubt on the accuracy of the number, 750, which expresses, according to my experiments, the atomic weight of uranium. He denies to the protoxide of uranium the radical part which I attribute to it. He denies that peroxide of uranium possesses any exceptional property; according to him, uranium resembles iron in its combinations, and, like the peroxide of this latter metal, it gives rise to basic salts soluble in water. The just deference with which we all receive the critical observations of M. Berzelius, made it my duty to pursue my investigations concerning uranium, and to submit to new proofs the opinions which I have enunciated relative to the nature of the compounds of this metal.

As I propose shortly to return to the question of the atomic weight of uranium, I will only remark that the number 800, which Berzelius considers more accurate than that which I have adopted, and which he deduces from a few experiments formerly made on the oxidation of uranium (protoxide of uranium), cannot be admitted; for it disagrees with the very numerous analyses of the salts and oxides of uranium, made by M. Ebelmess, who was led to the number 742·8; by M. Rammelsberg, who adopts the 750, the same as I have proposed; finally, by M. Wertheim, who arrived at the number 740·5. It is, therefore, very probable that the true number is somewhere between 740 and 750.

Berzelius refuses to admit that the protoxide of uranium acts as a radical, because, says he, this body is a salifiable base. I thought that I had prevented this objection, by not attributing this double part to the same body; I supposed, indeed, that the oxide of the green salts presents a different molecular constitution from uranyle: it is possible, as I said, that, although they have the same ponderal composition, they may be, with respect to one another, as methylen gas is to olefiant gas, that their state of condensation may be different. Do not the very different functions which the elements of ammonia and cyanogen perform in the compounds to which they give rise, furnish in-

* *Comptes Rendus*, No. 16, April 15, 1844.

disputable examples of moleeular modifications of the same order?

With respect to the salts of peroxide of uranium, that Berzelius admits, without any hesitation, peroxide of uranium produces in preference, with the acids, *soluble basic salts*, and that it gives rise to double salts, with the neutral salts of other bases. He assures us that other oxides act like it. It would not, perhaps, have been useless to have namcd these oxides. I know of none which, like peroxide of uranium, form crystallisable, soluble basic salts, endowed with all the properties of neutral salts, most frequently to the exelusion of every other saline compound of the same acid; for it must be remarked that, by regarding, exclusively, the composition of the salts of peroxide of uranium, we are led to admit that their oxide, which forms so great a number of tribasic salts, is not eapable of forming any neutral salt. However, all chemists regard neutrality as the most stable, and most usual, state of saline eompounds.

Indeed, Berzelius admits the existence of three sulphates of uranium—namely, SO^3, U^2, O^3; 2 SO^3, U^2 O^3; 3 SO^3, U^2 O^3. The last is formed, aecording to him, when SO^3 U^2 O^3 is crystallised in concentrated sulphuric acid, and it constitutes the neutral salt. I have in vain endeavored to produce it, by operating in the circumstances indicated by Berzelius: I obtained a very acid salt, whose composition is 2 SO^3 (U^2 O^2) OHO. This salt consequently furnishes a new argument in favor of the radical part, which I attribute to the protoxide of uranium. It is equivalent to bisulphate of potassa, 2 SO^3, KO, HO.

This mode of making the composition of the salts of uranium agree with their properties, is rendered still more neeessary by the existenee of the following salts. I have purposely chosen them of the most complex and best known kinds:—

SULPHO-METHYLATE OF PEROXIDE OF URANIUM.

This salt is prepared by deeomposing sulphate of uranyle, SO^3 U^2 O^3, 3 HO, by sulphomethylate of baryta; by evaporating, *in vacuo*, the liquor obtained by double decomposition, it furnishes crystals in large leaves, which are extensively deliquescent. The analysis of this salt leads to the formula 2 SO^3 (U^2 O^3) O, C^2 H^3 O, HO.

This composition appears to solve the question relative to the state of saturation of uranium, for no basic sulphomethylates are known; besides, the property which the liquor obtained by double decomposition possesses of crystallising entirely, giving the salt whose composition I have just presented, and of precipitating the salts of baryta when it contains a larger proportion of sulphuric acid—a proof that the existence of another sulphomethylate, even in the state of solution, is not admissible.

TARTRATE OF PEROXIDE OF URANIUM.

By putting in contact equal weights of peroxide of uranium and tartaric acid, dissolved in water, a yellow liquor is obtained, which furnishes, by concentration, a crystalline deposit of tartrate of uranium. The cold mother-liquor, left to spontaneous evaporation, gives crystals which contain a greater proportion of water; their composition is represented by the formula—

$$C^8\ H^6\ O^{12},\ 2\ (U^2\ O^2)\ O,\ 6\ HO.$$

This salt loses six equivalents of water when it is dried at 248° F.; when it is deposited from a boiling liquor, it does not contain them.

I have in vain endeavored to remove from it a larger proportion of water by heating it to above 392° F.

DOUBLE TARTRATE OF URANYLE AND ANTIMONY, OR URANIC EMETIC.

This remarkable salt is precipitated in the gelatinous state when two cold solutions, one of nitrate of uranium, the other of ordinary emetic, are mixed; after some time this deposit becomes crystalline; boiling and dilute liquors do not furnish any immediate precipitate, and the crystals are formed in a direct manner by cooling; they are silky, sparingly soluble in cold water, and slightly effervescent.

Their analysis, performed a great number of times, and in very various circumstances, led to the following formula:—

$$C^8\ H^2\ O^8,\ (U^2\ O^2)\ O,\ Sb.\ O^3\ 4HO+7HO$$

In the dry vacuum, it loses 7 equivalents of water; at 392° F., it disengages 4 more, and it becomes C^8 H^2 O^8, (U^2 O^2) O, Sb^2 O^3.

The tartaric acid is consequently found in the same state as in ordinary emetic, dried at 392° F., aecording to the analysis of MM. Dumas and Stas.

Thus, in uranic emetie, *the oxide*, U^2 O^3, *replaces the potassa of the ordinary emetic.* I do not hope to meet with a more conclusive faet in favor of the constitution which I attribute to this oxide.

The existence of this salt leads, moreover, to another important consequence; it may, in my opinion, be admitted by induction, that the constitution of the peroxide of uranium is not so exeeptional as might at first be supposed; by extending it, indeed, to the protoxide of antimony, and by considering this body as a monoxide (Sb^2 O^2) O, the composition of ordinary emetic is made to agree with its hitherto very embarrassing

properties, which are those of a neutral compound, although this compound is basic in composition. This mode of interpreting the facts introduces unexpected simplicity into the mode of representing the tartrate, since ordinary emetic becomes the salt corresponding to the neutral tartrate of potassa and cream of tartar, dried emetic being $C^8\ H^2\ O^8\ KO,\ (Sb^2\ O^2)\ O$.

The same simplicity is maintained if we regard emetic as a double salt, or if it be admitted that the hydrogen is replaced in organic matters and in the acids, by metals or compound radicals; this theory, which Davy and Dulong first advanced, and which the present tendencies of organic chemistry render so plausible, is applicable to the tartrates only, if it be admitted that $U^2\ O^2$ and $Sb^2\ O^2$ replace one equivalent of hydrogen, potassium, or any other metal. This is not, therefore, one of the least arguments to be adduced for justifying the radicals whose adoption I propose.

By regarding protoxide of antimony as formed of $(Sb^2\ O^2)\ O$, the powder of algaroth, $2\ Sb^2\ O^3 + Sb^2\ Cl^3$, becomes $(Sb^2\ O^2)\ Cl$; it corresponds to the chloride of uranyle $(U^2\ O^2)\ Cl$.

Finally, the protoxide of bismuth probably belongs to this series of oxides which differ from the peroxides of iron and alumina, the protoxide of chrome, &c., in forming, contrary to these latter, neutral salts by combining with one equivalent of acid. The nitrate of bismuth is, indeed, $NO^5,\ Bi^2\ O^3\ 3HO$.

In conclusion, the general laws of the composition of salts being thus found defective, it seems that they can be retained in their integrity only by admitting the existence of oxidised radicals, of which the peroxide of uranium presents so remarkable an example.

MEMOIR ON THE COMBINATIONS OF PHOSPHORUS WITH HYDROGEN.*

BY M. PAUL THENARD.

In studying the combinations of hydrogen with phosphorus, I have arrived at results, some of which appear to me worthy of attention, and of which I will now content myself with giving a summary.

I. There exist at least three phosphurets of hydrogen; one solid, another liquid, and the third gaseous. The solid phosphuret contains less hydrogen than that which is liquid, and the latter less than that which is gaseous.

II. Solid phosphuretted hydrogen, first noticed by M. Leverrier, is obtained by various processes, but especially by passing spontaneously inflammable phosphuretted gas into concentrated hydrochloric acid, filtering the liquor, washing the precipitate with cold water, and rapidly drying the matter under the pneumatic machine.

M. Leverrier, who procured it by other means, found it to be formed of one equivalent of phosphorus and one equivalent of hydrogen; according to me, it is composed of two equivalents of phosphorus, and one equivalent of hydrogen.

III. Gaseous phosphuretted hydrogen is the phosphuretted hydrogen which is not spontaneously inflammable. It is easily prepared, and obtained perfectly pure, and by projecting phosphuret of calcium into almost fuming nitric acid, by means of a *vertical* (?) tube dipping into the acid liquid. At the same time that the gas is formed, a large quantity of a yellow matter, which appears to be solid phosphuretted hydrogen, is produced.

When, instead of acid, water alone is employed for the preparation of phosphuretted hydrogen gas, the latter, as is known, is always spontaneously inflammable, but it is never pure; it always contains hydrogen gas, whose quantity increases with the duration of the experiment, but, nevertheless, the real quantity of phosphuretted hydrogen gas is greater than under the influence of acid.

These differences are owing to the circumstance that, with water alone, a hypophosphate is formed, and the solid phosphuretted hydrogen, produced at first, is afterwards decomposed; whilst, with the acid, little or no hypophosphorus acid, much solid phosphuretted hydrogen, on the contrary, is formed. The quantity of free hydrogen is also always in direct ratio to that of the hypophosphorus acid, and in the inverse ratio of the solid phosphuretted hydrogen.

IV. The spontaneously inflammable phosphuretted hydrogen gas loses its inflammability when it is put in contact with the protochloride of phosphorus, and hydrochloric and hydrobromic acids; left to itself, it gradually loses this property. Light singularly hastens its decomposition: in all cases it allows solid phosphuretted hydrogen to deposit, and passes to the state of phosphuretted hydrogen gas, which is not spontaneously inflammable. This latter gas also resists the action of all the foregoing agents.

V. But of all the phenomena which I have observed, the most remarkable are those of which it remains for me to speak.

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* *Comptes Rendus*, No. 16, April 15, 1844.

I had seen that by gradually projecting into very dilute hydrochloric acid, phosphuret of calcium mixed with phosphate of lime, which performs no part in the reaction, a poissuse matter is sometimes deposited, which, by the contact of air, suddenly took fire, and which could only be phosphuretted hydrogen.

I knew that spontaneously inflammable phosphuretted hydrogen gas lost its inflammability in the solar light—that it then gave rise to a very slight deposit of phosphuretted hydrogen, and was converted into ordinary phosphuretted hydrogen gas.

I likewise knew that only a few bubbles of spontaneously inflammable phosphuretted hydrogen are required for communicating this property to more than a quart of phosphuretted hydrogen gas, which was not so, or even to pure hydrogen gas.

Finally, I knew that spontaneously inflammable hydrogen gas contained a very great quantity of gas which was not so.

Being guided by all these observations, I was led to believe that the cause of the spontaneous inflammability of phosphuretted hydrogen gas might depend on a very small quantity of highly inflammable matter; that this matter might be liquid at the ordinary temperature, and that it might communicate the property of inflaming to the phosphuretted hydrogen gas, which did not possess it, by being reduced into vapor, in very minute proportions.

Consequently, I passed several quarts of spontaneously-inflammable hydrogen gas into glass tubes bent into the form of the letter U, and cooled at 20°, taking care at the same time to gently heat the apparatus in which the gas was produced; and I was fortunate enough to see very soon condensed a colorless and perfectly limpid liquid, which possessed all the properties which I had anticipated; it was evidently the phosphuretted hydrogen which I sought.

This phosphuret is liquid below + 50°; its tension is considerable; it is as colorless and transparent as water when pure. As soon as it comes in contact with the air it inflames vividly, and burns with a very intense white light, giving rise to thick fumes. Exposed in a bent tube to the solar light, it is rapidly converted into inflammable phosphuretted hydrogen gas, and into solid phosphuretted hydrogen.

When it is kept from the light, and submitted to a temperature of about 59° F., it seems to assume the gaseous form without undergoing decomposition.

The smallest quantity of this liquid renders spontaneously inflammable the phosphuretted hydrogen gas which is not so, and hydrogen gas itself. It is probable that it would communicate the same property to all other combustible gases.

Phosphuretted hydrogen gas, thus rendered spontaneously inflammable, completely resembles the phosphuretted hydrogen gas which is naturally so.

Hydrochloric and hydrobromic acids, and protochloride of phosphorus, immediately decompose liquid phosphuretted hydrogen, and convert it into solid phosphuretted hydrogen, and into phosphuretted hydrogen gas which is not spontaneously inflammable.

It would be very dangerous to keep liquid phosphuretted hydrogen in tubes closed and exposed even to diffused light: they might inflame. These tubes should be closed, and completely buried in sand, in order to keep them from the light.

I have not yet analysed the liquid phosphuretted hydrogen; I think, from the action which the solar light exerts on it, that its composition differs from that of uninflammable phosphuretted hydrogen gas; and if it were thus, it would be more hydrogenous than the solid phosphuret, and less so than the gaseous phosphuret.

Indeed, Rose, who is so great an authority in chemistry, has established by experiments, whose accuracy I do not dispute, that the inflammable and uninflammable phosphuretted hydrogen gases give the same results by analysis; but these results are not extraordinary, since only a few traces of liquid phosphuretted hydrogen are required for rendering spontaneously inflammable that which is not so. However, I am about to determine its composition by direct experiments; although liquid and spontaneously inflammable, it is not impossible that it may be isomeric with the phosphuretted gas which inflames only at a high temperature.

At all events, if I am not mistaken, it will be easy to account for all the phenomena which the phosphuretted hydrogen gases present, concerning the interpretation of which so much vagueness and uncertainty remains in the minds of even the most distinguished chemists.

In concluding this note I should mention that in all my experiments, I have always used phosphuret of calcium, prepared in a peculiar apparatus, by passing a great excess of phosphurus through pure lime, previously carried to a very high temperature. A large quantity of phosphuret of calcium, mixed only with phosphate of lime, is thus very easily procured.

I intend to continue my investigations; and if I obtain new results, worthy of being presenting to the Academy, I will hasten to submit them to its judgment.

ANALYSIS OF THE MINERAL WATER AT DRIBURG.*

BY F. VARRENTRAPP.

The water of the spring in the hall at Driburg, which was newly enclosed last year, is perfectly clear, very pearly, of a pungent and somewhat saline ferruginous taste, depositing, when for some time in contact with the air, a reddish-yellow precipitate, consisting of carbonate of lime and oxide of iron, its temperature constantly being $8\frac{3}{4}$°R. ($51°\frac{11}{16}$F.).

DETERMINATION OF THE SPECIFIC GRAVITY.

A bottle which, at a temperature of 8·75°R. ($51°\frac{11}{16}$F.) contained 88·997 of Driburg mineral water, contained at the same temperature only 886·05 grms. of distilled water; hence the specific gravity of the mineral water = 1·004427.

Another bottle, which contained 1064·83 grms. of mineral water, held only 1059·08 grms. of distilled water, hence the specific gravity of the mineral water = 1·004570.

QUALITATIVE ANALYSIS.

Exposed to the air, and quicker when heat was applied, the water became turbid, disengaging much carbonic acid gas and depositing a reddish-yellow precipitate. This precipitate consisted chiefly of carbonate of lime and oxide of iron, with an admixture of a slight quantity of clay, manganese, phosphoric acid and silica, crenic and apocrenic acids.

The quantity, however, of these latter substances found therein was so inconsiderable that it could not be ascertained with precision, though their presence was evident in the residue obtained by boiling 100 pounds till $1\frac{1}{2}$ pounds were left, and the insoluble substances were removed. On evaporating the water to that extent, the residue was found to contain much sulphate of lime; it being intended that the deposit formed by boiling be freed from it, the evaporated water was to be compensated by distilled water. In the water that had been boiled, after filtration, was found a considerable quantity of lime and sulphuric acid, soda, some potassa, chlorine, and magnesia. Bromine, iodine, fluorine, and lithium could not be detected in the water.

QUANTITATIVE ANALYSIS.

I. DETERMINATION OF THE CHLORINE.

a. 71·00 grms. water yielded 0·029 grms. chloride of silver, which shows 1·007 of chlorine in 10000 parts of water.

b. 142·005 grms. water yielded 0·059 chloride of silver, which shows 1·025 of chlorine in 10000 parts of water.

II. DETERMINATION OF THE SULPHURIC ACID.

a. 415·16 grms. of water yielded 1·501 sulphate of baryta, which shows 12·43 parts of sulphuric acid in 10000 of water.

b. 418·06 grms. water yielded 1.520 sulphate of baryta, which shows 12·49 sulphuric acid in 10000 of water.

III. DETERMINATION OF POTASSA AND SODA.

a. 999·05 grms. of water yielded 0·501 grms.

b. 470·76 water yielded 0·236 grms. of a mixture of chloride of potassium and chloride of sodium.

The residue obtained from *a*, on being dissolved in some water, and treated with chloride of platinum, yielded 0·110 of potassio-chloride of platinum, showing 0·039 chloride of potassium, hence 0·33 parts of chloride of potassium in 10000 of water; consequently, 10,000 parts of water contain 4·685 chloride of sodium, and 0·33 parts of chloride of potassium, which shows 2·496 parts of soda, and 0·208 of potassa, or 0·173 of potassium.

IV. DETERMINATION OF THE IRON AND CLAY.

a. 233·92 grms. water yielded 0·008 grms. oxide of iron mixed with some clay.

b. 1169·60 grms. water yielded 0·040 grms., which on being treated with caustic potassa, gave 0·004 grms. of clay. This shows, on determining the quantity of the oxide of iron, by calculating that of the carbonate of the protoxide, that 10000 parts of water contain 0·45 parts of the carbonate of protoxide of iron, and 0·03 parts of clay.

V. DETERMINATION OF THE WHOLE QUANTITY OF LIME.

a. 1169·60 grms. water yielded 2·494 carbonate of lime, showing, therefore, 21·323 parts in 10000 of water; hence 12·003 of caustic lime.

b. 492·34 grms. water yield 1·040 grms. carbonate of lime, thus showing 21·123 parts in 10000 parts of water, and, consequently, 11·910 of caustic lime.

VI.

The water on being boiled for some time, and the evaporated portions compensated by new additions of water, yielded a precipitate amounting in 223·92 grms. water to 021

* *Annalen der Chemie und Pharmacie*, Band. xlix., Heft. 2, February, 1844.

grms., consequently, to 9·36 parts in 10000 of water.

b. 492·37 grms. water on boiling yielded 0·470 grms. of an insoluble residue, showing 9·54 parts in 10000 water.

VII. DETERMINATION OF THE SULPHATE OF LIME.

a. 492·37 grms. water, on being boiled and filtered, yielded 0·591 of the carbonate of lime, thus showing 0·158 grms. of caustic lime; hence 6·78 in 10000 of water.

b. 233·94 grms. of water, on being boiled and filtered, yielded, 0·28 of the carbonate of lime, thus showing 0·158 grms. of caustic lime; consequently, in 10000 parts of water 6·75.

VIII. DETERMINATION OF THE MAGNESIA.

492·34 grms. water yielded 0·05 of phosphate of magnesia, thus showing 0·018 of magnesia; consequently, 0·373 parts in 10000 parts of water; hence 1·096 of sulphate of magnesia.

IX. DETERMINATION OF THE WHOLE AMOUNT OF THE SOLID SUBSTANCES.

a. 470·67 grms. water evaporated at a temperature of 200° R. (482° F.) to dryness, left a solid residue amounting to 1·549 grms., thus showing in 10000 parts of water 32·91 parts of solid substances.

b. 1169·1 grms. water evaporated to dryness at a temperature of 200° R. (482° F.) left a solid residue amounting to 3·8495, thus showing 32·928 parts in 10000 parts of water.

X. DETERMINATION OF THE CARBONIC ACID.

239·8 grms. of water, on being treated with ammonia and chloride of calcium, in three different experiments, threw down a precipitate, from which, by the apparatus recommended by Fresenius and Will, an amount of carbonic acid was obtained in—

a. 0·843 grms.
b. 0·849 ,,
c. 0·850 ,,

Hence the whole of the carbonic acid in 10000 of water is 35·146, and the carbonic acid in its free state, having in view Nos. 4, 5, and 7, where carbonic acid is considered in its combined state, amounts to 30·946 parts, thus showing 16·194 *cc.* (cubic centimetre) in 10000 grms. of water at $8\frac{3}{4}$° R. ($51\frac{11}{16}$° F.) and 77mm (30°) atmospheric pressure.

From the foregoing it results that the following is the composition of the spring of Driburg:—

PERSONAL DIRECTIONS.

10000 parts of water contain—		GRS.	1 lb. = 16 oz. = 7680 grs.—	GRS.
0·330 Chloride of potassium	Potassium	0·174	Chloride of potassium	0·253
	Chlorine	0·156	Chloride of sodium	1·120
1·459 Chloride of sodium	Sodium	0.570	Sulphate of soda	3·030
	Chlorine	0·869		
3·945 Sulphate of soda	Soda	1·729	Sulphate of magnesia	0·842
	Sulphuric acid	2·216		
1·096 Sulphate of magnesia	Magnesia	0·373	Sulphate of lime	12·547
	Sulphuric acid	0·723		
16·337 Sulphate of lime	Lime	6·786	Carbonate of iron	0·345
	Sulphuric acid	9·551		
0·450 Carbonate of protoxide of iron	Protoxide of iron	0·280	Carbonate of iron	0·345
	Carbonic acid	0·170		
0·030 Clay		0·030	Clay	0.023
0·005 Silica		0·005	Silica	0·004
9·230 Carbonate of lime	Lime	5·200	Carbonate of lime	7·088
	Carbonic acid	4·030		
30·946 Carbonic acid in its free state, 30·946 grms. = 16·194 cubic centimetres at an atmospheric pressure of 76mm (29·9212 inches) and a temperature of $8\frac{3}{4}$° ($51\frac{11}{16}$° F.)			Carbonic acid in its free state 23·766 = 51·6 cub. inches atmos. press. 76mm (29·9212 inches), temperature $8\frac{3}{4}$° R. ($51\frac{11}{16}$° F.).	

MINERAL WATER OF THE HERSTER SPRING, NEAR DRIBURG.

The Herster Spring is situated at one hour's distance from Driburg, containing, according to the following results, nearly the same substances as the mineral water of Driburg, yet essentially differing by the greater amount of sulphates of magnesia and soda, and a less quantity as well of oxide of iron as of the carbonic acid in its free state.

The following are the calculated results :—

				GRAINS.
Water contains in 10000 parts.			1 lb.	7680
0·533	Chloride of potassium	Potassium.	0·280	0·409
		Chlorine	0·253	
0·091	Chloride of sodium	Sodium	0·036	0·069
		Chlorine	0·055	
5·439	Sulphate of soda	Soda	2·343	4·177
		Sulphuric acid	3·006	
3·650	Sulphate of magnesia	Magnesia	1·245	2·803
		Sulphuric acid	2·415	
12·587	Sulphate of lime.	Lime.	5·225	9·662
		Sulphuric acid	7·356	
0·156	Carbonate of protoxide of iron	Suboxide of iron	0·096	0·120
		Carbonic acid	0·060	
11·970	Carbonate of lime	Lime.	6·743	9·192
		Carbonic acid	5·227	
30·150	Carbonic acid in its free state, equal to 50·35 cubic inches.			23·162
30·150	grms. carbonic acid = 16600 cubic centimetres, at + 10° R., (54½° F.), and 76mm (29·9212 inches).			
35·446	of the whole amount of carbonic acid			27·222
34·510	of the whole of solid substances, found.			26·503
34·420	of the whole of solid substances, as resulting from additions of the single determinations			26·434
12·077	Precipitate thrown down on boiling			9·275

Furthermore, in 50 lbs. evaporated to a residue of 1 lb., have been discovered traces of clay, silica, crenic and apocrenic acids, but less than in the water of Driburg.

SKETCH OF DRIBURG.

Driburg (formerly Iburg) is a small town in Westphalia, government Minden, Paderborn, on the east side of the Teutoburg forest, where the Roman general Varus was sadly defeated by Hermann, the leader of the German forces. It contains about 1,600 inhabitants.

In its vicinity, a tower, with some decayed walls, are noticed, where, in ancient times, stood the castle of Iburg, erected, according to some, by Pipinns.

Owing celebrity to its mineral waters, this town is situated in a valley, representing a bell-shaped cavity. From the north, east, and south, we mount by a gently-ascending hill, on reaching the summit of which, on a sudden, the whole is displayed to our view, being then placed upon a height of an annular shape, which surrounds the dale, descending inwards by a steep declivity. The fountain is 633 feet above the level of the sea, and first acquired renown at the latter end of the 17th century, when several plantations were made at the command of the Bishop of Fürstemberg, and a description was given of the fountain in 1668 by Bernard Rottendorf, his archiater. Nessel gave the first chemical analysis of it in 1714. The fountain was first cleansed in 1755.

When the bailiff Meyer was tenant of the fountain in the year 1769, the demand for the water became brisk, and much of it was sent away; but, since Baron Sierstorf bought it, in the year 1782, it has been more frequented by visitors. The main spring is enclosed by a little building, of an octangular form, yielding 3,150 quarts—about 800 gallons—in an hour. Besides that, there are the Lonisenborn, Herster, and Satzer fountains.

Until lately, the following two analyses have been considered of some credit.

Sixteen ounces of the mineral water contain :

	According to Westrumb. GRAINS.	According to Du Menil. GRAINS.
Sulphate of soda	11·17	6·535
Muriate of soda	0·13	0·283
Sulphate of lime	10·68	10·973
Muriate of lime	0·06	—
Carbonate of lime	6·80	7·727
Sulphate of magnesia	2·85	7·217
Muriate of magnesia	0·90	0·574
Clay	0·05	—
Resinous extract	0·13	0·020
Carbonate of oxide of iron	1·33	0·688
Carbonate of magnesia. . . .	—	0·099
Silica	—	0·062
	34·10	34·143

CUBIC INCHES.

Carbonic acid 28·00—Westrumb.
34·99—Du Menil.

—nt—

[The attention of the English public having been very lately directed to the German

Spas by Dr. Granville's excellent Work on that subject, we intend to communicate to our readers the most recent and warranted analyses in succession, taking care to add a topographical notice each time.]

ON SOLUBLE ALBUMEN.*

BY ADOLPH WURTZ.

Animal albumen is almost always met with in alkaline liquors, charged also with different salts. It has been believed that its solubility in water is owing only to the presence of these inorganic materials. Such is the opinion given by Scherer.† However, the experiments on which this opinion is based are not quite free from objection ; ‡ and the conclusions which have been drawn from them are weakened by the facts which I shall mention in the course of this work. I have succeeded, indeed, in disengaging albumen from the foreign principles which accompany it, without impairing its solubility in water. The following is the process which I employ for preparing pure albumen :—

White of egg, mixed with twice its bulk of water, is strained, in order to tear the cellules. Into the filtered liquor is poured a little subacetate of lead, which determines an abundant precipitate. It is necessary to avoid adding an excess of a salt of lead, for the precipitate would be dissolved. After having been washed, water is added to the mass, in such a manner as to form a pap, and a current of carbonic acid is passed into it.

The liquor, at first thick, soon loses its consistence, an abundant froth being at the same time formed. The albuminate of lead is decomposed by carbonic acid ; carbonate of lead is formed, which remains suspended, and the albumen which is liberated is dissolved in water. It is filtered through paper washed with acid, in order to separate an albuminous deposit, to which I will recur further on. The albumen which has passed through the filter is not yet pure ; it contains traces of oxide of lead : a few drops of an aqueous solution of sulphuretted hydrogen are added ; the liquor turns brown, but remains transparent, for the sulphuret of lead is not precipitated. In order to separate it, it is cautiously heated at 140° F., until the liquor becomes turbid ; the first flocks of albumen carry down all the sulphuret of lead on being precipitated. The liquor, rendered colorless by filtration, is evaporated in large capsules at a temperature of 122° F. The residue constitutes solid albumen in the pure state.

The solution of albumen in pure water and coagulated albumen present a feeble acid reaction. If coagulated albumen be digested, at a gentle heat, with carbonate or bicarbonate of soda, it combines with the soda, displacing the carbonic acid. Indeed, if, after some time, the matter be collected on a filter, and submitted to prolonged washing, it is found completely neutral to litmus paper ; but, by incineration, it leaves a strongly-alkaline residue.

Hruschauer likewise proved this acid reaction in albumen precipitated by sulphuric acid, and purified by long washings.

Again, Jones and Rochleder have proved that perfectly pure caseïn and legumine feebly redden tincture of litmus.

If a solution of pure albumen be heated to 139° F., it begins to become turbid ; from 141° to 145° F., flocks are formed in the liquor, and, at a little higher temperature, the whole assumes the form of a mass. It is evident that the solution of pure albumen acts exactly like white of egg.

I have taken the greatest care to verify and to indicate all these properties of pure albumen, with the view of proving its identity with the matter which exists in the white of egg. It remains for me to point out the results which the analyses of several samples of albumen have afforded me.

The following is the composition of solid albumen :—

	II.	III.
Carbon	52·88	52·70
Hydrogen	7·19	7·06
Nitrogen	15·56	12·55
Oxygen, &c.	24·38	24·69
	100·00	10·000

For insoluble albumen we have—

	B	D Sample treated by ether.
Carbon	52·92	52·82
Hydrogen	7·15	7·23
Nitrogen.....	15·65	,,
Oxygen, &c.	24·28	,,
	10·000	

It is evident that the composition of albumen purified by the above-described process is uniform. These analyses agree, moreover, with those published by MM. Dumas and Cahours.

I have likewise endeavored to purify the

* *Comptes Rendus*, No. 16, April 15, 1844.

† *Annalen der Chemie und Pharmacie*, vol. xl., p. 1.

‡ Berzelius, *Jahresbericht*, 1842, p. 543.

albumen of the serum; but the precipitate which the subacetate of lead forms in the serum of blood, is only very incompletely decomposed by carbonic acid, and furnishes only extremely weak albuminous liquors. Consequently, I have renounced this process of purification.

ON THE AMOUNT OF MANNITE CONTAINED IN THE AGARICUS PIPERATUS.*

Some time ago, one of us, in conjunction with M. Pelouze, showed that the sweet substance of several species of mushroom, viz., that of *Cantharellus esculentus* and *Clavellaria coralloides*, is nothing else than mannite.

From this statement it became probable that the mushroom-sugar of Braconnot, which is considered as capable of undergoing fermentation, is merely mannite mixed with a portion of a known kind of sugar. It was, however, admissible that some other species of mushroom might really contain a variety of sugar, which is *sui generis*, and liable to ferment. For these reasons Messrs. Knop and Schnedermann, on examining the acrid substance of the *Agaricus piperatus*, directed their attention to the so-called mushroom-sugar. And it appeared, both from the peculiar properties and the analyses, that the sweet substance of that particular mushroom was nothing but mannite extracted in considerable quantities.

A large quantity of that mushroom was pressed, the juice obtained separated, treated first with acetate of lead, and then with sulphuretted hydrogen, and evaporated to the consistence of an extract; and, in that state, after having been treated with alcohol, the latter liquid was again removed by distillation.

The residue, representing a solid brownish crystalline mass, on being repeatedly treated with alcohol and animal charcoal, yielded with some facility colorless mannite.

—nt—

ON OIL OF CHAMOMILE.†

The volatile oil of *Matricaria chamomilla*, distinguished by its deep blue color, has not hitherto been subjected to a closer investigation. It is not known whether this color be attributable to the oil itself, or to a volatile substance dissolved in it; whether it be one oil or a compound of several oils, one of which might be blue, and the other colorless. The small quantity in which it can be obtained, and its high price, make a thorough investigation impossible. Some experiments made by M. Bornträger with oil obtained from pure chamomile flowers gave the following results:—

On being distilled several times with water, it retains its deep blue color; the first drops are of the same blue tint as the last ones. It is known that the water which distils over with it is colorless. On being shaken with ether, and after this latter substance has been allowed to evaporate, a small quantity of an almost colorless oil remains, the odor of which is essentially different from that of the blue oil. The blue oil is soluble in alcohol as well as in ether, with a blue color. On allowing the blue oil to cool to a degree below 0°C. (+ 32° F.) it thickens, very similar in appearance to a solid. In this manner, however, no stearopten could be separated, though the oil, as it occurs in commerce, if it be very dense, sometimes clearly exhibits lamellæ of colorless stearopten.

The following are the results of four analyses which have been obtained after the oil was left in contact for a whole fortnight with fused chloride of calcium:—

	I.	II.	III.	IV.
Carbon	79·85	79·81	79·56	78·26
Hydrogen ..	10·60	10·69	10·83	
Oxygen	9·55	9·50	9.61	

Analyses No. 3 and No. 4 were made with an oil which was distilled by itself. No. 3 was the portion which first passed over. No. 4 passed over last of all. In the retort remained a brown resin-like mass. The gas of the oil is perfectly colorless.

—nt—

ON THE CONVERSION OF FIBRIN INTO BUTYRIC ACID.*

BY ADOLPH WURTZ.

If fibrin be left in the air during the heat of summer, it is completely liquified at the end of eight days. The liquid gives out an odor of mouldy cheese, and coagulates by heat. This latter property is due to the albumen which it contains, and which may easily be isolated by precipitating the liquor diluted with water, and filtered by subacetate of lead, washing the deposit and decomposing it by a current of carbonic acid. There is thus obtained a solution coagulable by heat, which presents all the characters of albumen. The other products of this putrefaction are—car-

* *Annalen der Chemie und Pharmacie*, Band xlix., Heft 2, February, 1844.

† *Ibid.*

* *Comptes Rendus*, No. 16, 1844.

bonic acid, acetic acid, butyric acid, and ammonia.

To isolate the butyric acid, I diluted the liquid arising from the putrefaction of fibrin with twice its volume of water. I heated the liquor, and I added sulphuric acid in slight excess. The albumen precipitated was separated by the filter, and the clear liquor was distilled to half its bulk. The product of the distillation strongly reddened tincture of litmus; I neutralised it by carbonate of lead, and evaporated the solution. At a certain degree of concentration, butyrate of lead was separated from the liquor under the form of a thick oil, which became a soft and resinous mass on cooling. The liquor was decanted, evaporated to dryness, then redissolved in alcohol. The alcoholic solution, after having been mixed with water, was turbid, and allowed to deposit a new quantity of butyrate of lead, presenting the characters which I have just indicated. This salt was redissolved in weak alcohol, and decomposed by a sufficient quantity of caustic potassa. The filtered liquid was evaporated almost to dryness, then treated by concentrated phosphoric acid, which separated from the liquor an oily layer, which was removed in order to be distilled. The boiling point of the acid was rapidly raised from 266° to 320° F., and the product of the distillation, which was perfectly colorless, presented all the characters of butyric acid.

Putrefaction is not the only means by which fibrin is converted into a volatile fatty body. I have observed that by heating in an oil-bath, at temperatures of 320° and 356° F., pure fibrin, with lime and potassa, a small quantity of a volatile fat acid is formed, which remains combined with the potassa; whilst ammonia and other volatile products are disengaged. It is easy to extract the volatile fat acid from the residue, by dissolving the latter in water, supersaturating by phosphoric acid, and submitting the liquor to distillation. The distilled product is neutralised by an alkali, evaporated, and the residue is treated by phosphoric acid of a syrupy consistence, which separates from it an oily layer, easily ascertained to be a volatile fat acid. This acid presents the properties of butyric acid; however, I have not yet proved by analysis its identity with this latter acid.

INVESTIGATIONS CONCERNING ESSENTIAL OIL OF SASSAFRAS.*

BY M. SAINT-EVRE.

The oil of commerce, extracted from the wood of the *Laurus sassafras*, is presented under the form of a light yellow liquid, of a bitter taste, and of an odor resembling that of fennel. Its density is 1·09, at 50°F.; submitted to distillation, it begins to disengage green vapors towards 250°F. The boiling point afterwards rapidly rises to 410°F., at which it remains stationary, until the greater part of the liquid has disappeared.

This oil thus prepared, submitted to elementary analysis, gave the following results:

C^{18}	108	72·0
H^{10}	5	6·6
O^2	16	21·4
	129	100·0

But as, in causing bromine to act on the essence, a crystallised product is obtained, and as the analysis of this product prepared with the same oil presented great differences in the determination of the constituent elements, it appeared probable that a mixture of two oils had been operated on, and, consequently, it was necessary to separate them; besides, by passing into the distilled essence a stream of pure and dry ammoniacal gas, a liquid free from nitrogen was obtained, which was susceptible of crystallising, by cold and spontaneous evaporation, in very voluminous prisms. The analysis of these last crystals gave the following results:—

C	73·03	73.30
H	6·15	6·22
O	20·82	20·48
N	0·00	0·00
	100·00	100·00

Seeing the carbon increased in this manner, and the absence of nitrogen, I thought the oil should be submitted to a more intense cold, by placing it in a mixture of 12 parts of ice, 5 of common salt, and 5 of nitrate of ammonia. It first became opalescent, and being left to itself in the refrigerant mixture, at the end of five or six hours the vessel which contained it was found covered with bulky crystals, not less than half a centimètre in size, and perfectly white; they were rapidly pressed between folds of blotting-paper, melted and crystallised a second time by the same means, and the product was then ready for analysis.

These crystals, analysed with the greatest care, gave the following results:—

C^{20}	120	74·07
H^{10}	5	6·17
O^2	16	19·76
	141	100·00

ACTION OF BROMINE.

By pouring with the ordinary precautions a

* *Comptes Rendus*, No. 16.

suitable quantity of bromine on essence of sassafras, a violent reaction takes place: abundant vapors of hydrobromic acid are disengaged, and when they cease, the oil suddenly solidifies, and takes the form of a crystalline mass.

These crystals correspond to the formula of substitution $C^{20}\ {H^2 \atop Br^8}O^2$, which gives—

C^{20}	60	15·42
H^2	1	0·25
Br^8	312	80·20
O^2	16	4·13
	389	100·00

PREPARATION OF BENZOÏC ACID.*

Benzoïn, reduced to powder, is dissolved by applying heat, in nearly an equal bulk of highly rectified spirit of wine. The solution, while still hot, is mixed, by slow degrees, with as much hydrochloric acid as will begin to throw down the resin, and the mass is subjected to distillation. The benzoïc acid passes over under the form of benzoïc ether, partly as distinct drops, partly dissolved in the alcoholic distilled liquor. The distillation is continued as long as the consistence of the mass admits of it. On its becoming too dense, it is allowed to cool; and, after some hot water has been added, the distillation is to be resumed, and continued until ether is no longer obtained. The water remaining in the distilling apparatus is, while still boiling, poured off from the clear resin, which, on cooling, deposits benzoïc acid, probably originating from the decomposed benzoïc ether.

The distilled liquor obtained is digested with caustic potassa until the whole of the ether is decomposed, finally heated to ebullition, and saturated with hydrochloric acid. On cooling, the benzoïc acid separates by crystallisation. It seems that in this way the whole of the benzoïc acid contained in the resin had been extracted; and, with regard to its pharmaceutical use, it is to be kept in view that the acid obtained in the aforesaid manner is endowed with an odor just the same as that exhaled by the benzoïc acid procured by sublimation. I do not intend to maintain that the above given proportions of resin, muriatic acid, and alcohol, are the most appropriate ones.

—nt—

* *Liebig's Annalen.*

ON THE HYDROGURET OF COPPER.

BY ADOLPHE WURTZ.*

In examining the action of hypophosphorus acid on the salts of copper, I discovered, in certain circumstances, the formation of a hydroguret of copper, possessing all the characters of a definite compound. This body may be prepared in the following manner:—

One part of hypophosphite of baryta is dissolved in water, and the baryta is completely precipitated by sulphuric acid; 0.8 part of sulphate of copper in concentrated solution are added to the filtered solution. The mixture is gently heated to a temperature which should not exceed 158° F. The liquor takes a green tint, then a precipitate is formed which is at first yellow, but which becomes darker, until it presents the color of kermes. At this point of the operation a disengagement of a few bubbles of hydrogen is often remarked; the flask must then be quickly cooled. The cooled liquor is filtered, and the deposit is washed with water deprived of air, and in an atmosphere of carbonic acid. It only remains to dry the matter, by pressing the filter between folds of blotting-paper.

The dry hydroguret of copper inflames in chlorine with a production of thick vapors, which condense in flocks of chloride of copper. This incandescence is likewise observed in throwing it into bromine.

Hydrochloric acid exerts on hydroguret of copper a very remarkable action. With concentrated acid, even without heat, a vivid effervescence of hydrogen is produced, and chloride of copper is formed. If too great an excess of acid be not employed, this salt crystallises partly in small bracteæ, which are easily distinguished in the midst of a slight residue of copper. By the addition of a little water, the liquor becomes milky; it presents, besides, all the characters of the salts of copper. According to this, it is evident that the hydroguret of copper and the hydrochloric acid are both decomposed. I have proved this fact by direct experiments, by decomposing hydroguret of copper, on one hand, by heat alone, and on the other hand, by hydrochloric acid. In the second case, I obtained, for an equal quantity of matter, sensibly a double volume of hydrogen gas. It is known that hydrochloric acid attacks copper only with extreme difficulty; and the presence of hydrogen, far from favoring the reaction, should, according to the laws of affinity, add a new obstacle. The decomposition of hydroguret of copper appears, therefore, to be effected by virtue of an action of contact.

* *Comptes Rendus*, No. 16.

In four analyses, of different samples, I obtained the following numbers :—

	I.	II.	III.	IV.
Copper..	98·780	98·785	98·779	98·771
Hydrogen	1·220	1·215	1·221	1·229
	100·000	100·000	100·000	100.000

Calculation.

	C^2H	Cu^8H^3
Copper.....	98·446	98·830
Hydrogen*....	1·554	1·170
	100·000	100·000

By taking the foregoing analyses for a basis, it is found that, in the hydroguret of copper, the copper is combined with about 1200 times its volume of hydrogen.

ON THE COMPOSITION OF THE ASHES OF POTATOES.

BY DR. A. VOGEL, JUN.

The ashes of potatoes contain 17·5 per cent. of substances which are insoluble in water, and 82·5 per cent. of substances soluble in water.

The 17·5 parts are composed of 9 parts of phosphates, and 8·5 of carbonates. The phosphates consist chiefly of phosphate of lime mixed with some traces of phosphate of magnesia, clay, and oxide of iron. The carbonates consist of carbonate of lime, and a little carbonate of magnesia.

The constituent parts which are soluble in water are chiefly carbonates, sulphates, and phosphates, the base of which is an alkali, and some traces of metallic chlorides. It is very remarkable that in these ashes the quantity of soda exceeds that of the potassa. Three experiments gave the same results with regard to that particular point ; the soda obtained was constantly one per cent. more than the potassa. The whole of the phosphoric acid amounted to 5·33, and that of the sulphuric acid to 6·93.

No silica was contained in these ashes.

—nt.—

ON THE PREPARATION OF CARBONATE OF LITHIA.†

Lithia was discoved by Arfwedson, a Swedish chemist, in the petalite found at Uton, in Sweden ; it exists also in the spodumene found in the same locality.

To obtain this oxide, the ore which contains it is powdered, calcined with five times its weight of pure nitrate of baryta, in a platinum crucible ; the product of the calcination is treated with from fifteen to twenty times its weight of water ; an excess of hydrochloric acid is added which dissolves all the product ; it is evaporated to dryness ; the residue is treated by water acidulated with hydrochloric acid, and it is filtered to separate the silica. An excess of sulphuric acid is poured into the filtered solution in order to precipitate the baryta, then the liquor is supersaturated, from which the sulphate is separated with ammonia, which isolates the alumina ; the liquor which contains the sulphate of lithia is filtered, evaporated to dryness, and calcined to drive off the ammoniacal salts mixed with a sulphate.

The residue, which contains the sulphate of lithia, is treated by water, filtered, concentrated, and precipitated by carbonate of soda ; the precipitate is collected on a filter, washed with very little water, dried, and preserved.*

The carbonate of lithia is found in solution in some mineral waters, and particularly in those of Bohemia ; it is also found in some of the mineral waters of France. We can readily conceive the advantage which may be derived from these waters in the treatment of patients afflicted with gravel and vescical calculi.

The carbonate of lithia is rare, and difficult to be procured. It is desirable that further experiments be made relative to the efficacy of this salt, and that it be more commonly prepared, if this efficacy be well demonstrated.

ON THE PRESENCE OF PHOSPHATE OF LIME IN WINES.†

BY M. COLIN.

M. Belin and myself were charged in 1841, by the tribunal of Versailles, with examining a suspected wine, which we compared with some wine of Lower Burgundy on which we could depend, and in our report we noticed phosphate of lime, as existing in natural wines. This observation surprised us the less, as one of us, in his investigations concerning fermentation, had found phos-

* H = 12·5.

† *Journal de Chimie Médicale*, May, 1844.

* If it be wished, the sulphate might be decomposed by baryta-water ; the liquor is then filtered, and rapidly evaporated to obtain the lithia, which, exposed to the air, would pass to the state of carbonate.

† *Journal de Pharmacie*, May, 1844.

phate of lime in yeast; this salt, therefore, accompanies the ferment. A new chemical investigation has just been confided to us; we have taken, for comparison, some southern wines, and we have also found phosphate of lime in them. Consequently, M. Jacob, who has recently submitted to numerous analyses the wines of Tonnerre, is wrong in regarding this phosphate as peculiar to the wines of this growth.

PURIFICATION OF MERCURY.*

Mercury heated to 104° F. is agitated with a very concentrated solution of nitrate of mercury. By this operation, the foreign metals are oxidised and dissolved.

This simple and rapid process of purification of a metal so often altered by fraud, appears to us to merit the attention of chemists.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON A NEW MODE OF PREPARING THE PLATES DESTINED TO RECEIVE PHOTOGRAPHIC IMAGES.*

BY M. DAGUERRE.—LETTER TO M. ARAGO.

You have been kind enough to announce to the Academy that I had arrived, by a series of experiments, at recognising in a certain manner that, in the present state of my process, the layer sensible to light being too thin, could not furnish all the gradation of tints necessary for reproducing nature with relief and firmness; indeed, although the proofs hitherto obtained are not deficient in purity, they leave, with a few exceptions, much to be desired with relation to general effect and relief.†

It is by superposing on the plate several metals, reducing them to powder by friction, and by acidulating the empty spaces which the molecules leave, that I have been enabled to develop galvanic actions which permit the employment of a much thicker layer of iodide, without having to fear, during the operation of light in the camera obscura, the influence of the liberated iodine.

The new combination which I employ, and which is composed of several metallic iodides, has the advantage of giving a sensible layer capable of receiving impressions simultaneously by all the degrees of tone, and I thus obtain, in a very short space of time, the representation of objects vividly enlightened with demi-tints, all of which retain, as in nature, their transparency and their relative value.

By adding gold to the metals which I first used, I am enabled to avoid the great difficulty which the use of bromine, as an accelerating substance, presented. It is known that only very experienced persons could employ bromine with success, and that they were able to obtain the maximum of sensibility only by chance, since it is impossible to determine this point very precisely, and since immediately beyond it the bromine attacks the silver, and is opposed to the formation of the image.†

With my new means, the layer of iodine is always saturated with bromine, since the plate may, without inconvenience, be left exposed to the vapor of this substance for at least half the necessary time; for the application of the layer of gold is opposed to the formation of what is called the veil of bromine. This facility must not, however, be abused; for the layer of gold, being very thin, might be attacked, especially if too much polished.‡ The process

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* *Comptes Rendus*, No. 17, April 22, 1844.

† On the plate cleaned by means of the layer of water, as I have pointed out, very fine impressions are very rapidly obtained, but which are also wanting in relief, on account of the thinness of the sensible layer.

* *Archives der Pharmacie.*

† Every one knows that the dry vapor of bromine is more favorable than that which is obtained by means of a solution of bromine in water, for the latter has the inconvenience of carrying with it moisture which condenses on the surface of the plate. The employment of the oil, which I indicate further on, neutralises this effect, and gives to the vapor of bromine diluted with water the same property as that of dry bromine.

‡ This is so true, that if an impression be made on a plate which has been fixed several times, it may be exposed to the vapor of bromine as many times more than the ne-

which I am about to give may, perhaps, be found rather complicated; but, notwithstanding my desire to simplify it as much as possible, I have been led, on the contrary, by the results of my experiment, to multiply the substances employed, all of which play an important part in the whole process. I regard them all as necessary for obtaining a complete result, which must be the case, since I have only gradually arrived at discovering the properties of these different metals, one of which aids in promptitude, the other in the vigor of the impression, &c.*

From the concurrence of these substances arises a power which neutralises all the unknown effects which so often oppose the formation of the image.†

I think, besides, that Science and Art should not be interrupted by the consideration of a more or less long manipulation; we should be contented to obtain beautiful results at this price, especially when the means of execution are easy.

For the galvanic preparation of the plate does not present any difficulty. The operation is divided into two principal parts: the first, which is the longest, may be made a long time previously, and may be regarded as the completion of the manufacture of the plate. This operation, being once made, serves indefinitely; and, without recommencing it, a great number of impressions may be made on the same plate.

DESIGNATION OF THE NEW SUBSTANCES.

Aqueous solution of bichloride of mercury:
Solution of cyanide of mercury:
White oil of petroleum, acidulated with nitric acid:
Solution of chloride of gold and platinum.

PREPARATION OF THE SUBSTANCES.

Aqueous Solution of Bichloride of Mercury.—5 decigrammes of bichloride of mercury in 700 grammes of distilled water.

Solution of Cyanide of Mercury.—A flask of distilled water is saturated with cyanide of mercury, and a certain quantity is decanted, which is diluted with an equal quantity of distilled water.

*Acidulated White Oil of Petroleum.**—This oil is acidulated by mixing with it one-tenth of pure nitric acid, leaving it for at least 48 hours, occasionally agitating the flask. The oil, which is acidulated, and which then powerfully reddens litmus paper, is decanted. It is also a little colored, but remains very limpid.

Solution of Chloride of Gold and Platinum.—In order not to multiply the solutions, I take the ordinary chloride of gold, used for fixing the impressions, and which is composed of 1 gramme of chloride of gold, and 4 grammes of hyposulphate of soda, to a quart of distilled water.

With respect to chloride of platinum, 2½ decigrammes must be dissolved in 3 quarts of distilled water; these two solutions are mixed in equal quantities.

Modus Operandi.

FIRST PREPARATION OF THE PLATE.

Note.—For the sake of brevity in the following description, I will abridge the name of each substance. Thus, I will say, to designate the aqueous solution of bichloride of mercury, *sublimate;* for the solution of cyanide of mercury, *cyanide;* for the acidulated oil of petroleum, *oil;* for the solution of chloride of gold and platinum, *gold and platinum;* and for the oxide of iron, *rouge* only.

The plate is first polished with sublimate and tripoli, and afterwards with rouge,†

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cessary time as it has received layers of gold.

* I will only observe, that the employment of all the metals which I indicate further on, is indispensable; but the mode of applying them may be varied.

† For, by multiplying these elements as in a pile, this power is augmented, and we are thus enabled to make the most indolent radiations act in the same time, such as those of green and red.

* The most suitable oil of petroleum is of a greenish yellow tint, and takes, at different angles, azure reflections.

I have given the preference to this oil over the fixed oils, because it always remains limpid, although strongly acidulated. My object in employing an acidulated oil is to reduce the metals to powder, and to retain this powder on the surface of the plate, at the same time giving greater thickness to the layer by its unctuous properties; for the naphtha which results from the distillation of this oil does not produce the same effect, because, being too fluid, it carries away the powder of the metals. It is for the same reason that I have lately recommended the employment of essence of lavender rather than that of essence of turpentine.

† If I prefer, for polishing, rouge to other substances, it is not because I recognise in it a photogenic property, but because it *burnishes* better, and because it assists in fixing the layer of gold, rendering it less susceptible of being removed in scales when heated too much. The galvanic plates, when they are neither marbles nor black stains (which some-

until a beautiful black is arrived at. Then, the plate is layed on the horizontal plate, and the solution of cyanide is poured on it and heated over a lamp, as in fixing an impression with chloride of gold. The mercury is deposited, and forms a whitish layer. The plate is allowed to cool a little, and, after having poured off the liquid, it is dried by rubbing with cotton and sprinkling with rouge.

It is now necessary to polish the whitish layer deposited by the mercury. With a piece of cotton steeped in oil and rouge, this layer is rubbed until it becomes of a fine black. In the last place, it may be rubbed very strongly, but with cotton alone, in order to render the acidulated layer as thin as possible.

The plate is afterwards placed on the horizontal plane, and the solution of gold and platinum is poured on. It is heated in the ordinary manner; it is then allowed to cool, the liquid is poured off, and it is dried by gentle friction with cotton and rouge.

This operation must be performed with care, especially when the impression is not immediately continued; for, otherwise, some lines of liquid would be left on the plate, which it is difficult to get rid of. After this last friction the plates should be only dried, and not polished.

This concludes the first preparation of the plate, which may be made a long time previously.

SECOND PREPARATION.

Note.—I do not think it fit to allow a longer interval than 12 hours to intervene between this operation and iodising the plate.

We left the plate with a deposit of gold and platinum. In order to polish this metallic layer, the plate is rubbed with a piece of cotton, and oil and rouge, until it again becomes black; and then with alcohol and cotton only, in order to remove this layer of rouge as much as possible.

The plate is then rubbed very strongly, and passing several times over the same places, with cotton impregnated with cyanide. As this layer dries very promptly, it might leave on the plate traces of inequality; in order to avoid this, the cyanide must be again passed over it, and, while the plate is still moist, we quickly rub over the whole surface of the plate with cotton imbibed with a little oil, thus mixing these two substances; then, with a piece of dry cotton, we rub in order to unite, and, at the same time, to dry the plate, taking care to remove from the cotton the parts which are moistened with cyanide and oil. Finally, as the cotton still leaves traces, the plate is likewise sprinkled with a little rouge, which is removed by gently rubbing.

Afterwards, the plate is again rubbed with cotton impregnated with oil, only in such a manner as to make the burnish of the metal return; it is then sprinkled with rouge, and then very gently rubbed round, in such a manner as to remove all the rouge, which carries with it the superabundance of the acidulated layer.*

Finally, it is strongly rubbed with a rather firm pledget of cotton, in order to give the last polish.†

It is not necessary often to renew the pledgets of cotton imbibed with oil and rouge; they must only be kept free from dust. I have said above that the first preparation of the plate may serve indefinitely; but it will be comprehended that the second must be modified, according to whether we operate on a plate which has received a fixed or an unfixed impression.

ON THE FIXED IMPRESSION.

The stains left by the washing water must be removed with rouge and water slightly acidulated with nitric acid (at 36°F. at this season [April?], and less in summer).

Afterwards, the plate must be polished with oil and rouge, in order to remove all traces of the image.

The operation is then continued as I have just described for the second preparation of the new plate, and beginning with the employment of alcohol.

ON THE UNFIXED IMPRESSION (BUT WHOSE SENSIBLE LAYER HAS BEEN REMOVED IN THE ORDINARY MANNER).

First, the plate must be rubbed with alcohol and rouge, in order to remove the traces of oil which serve for receiving the foregoing impression.

We afterwards proceed as indicated above for the new plate, beginning with the employment of alcohol.

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times happened originally), receive better than others the application of metals, and, consequently, the chloride of gold adhering to it more firmly, is not removed in scales.

* This must be done as gently as possible; for, otherwise, the rouge would adhere to the plate, and would form a general film.

† In operating on a plate a long time after it has received the first preparation, it is necessary, before employing the acidulating oil and red oxide, to operate as I indicate further on for the plate which has received a fixed impression. This precaution is necessary for destroying the stains which time may have developed.

SUMMARY OF THE OPERATIONS.

First Preparation.

1. Corrosive sublimate, with tripoli first, and rouge afterwards, in order to polish the plate :
2. Cyanide of mercury, heated and dried with cotton and rouge :
3. Acidulated oil, with rouge for polishing the layer of mercury :
4. Gold and platinum, heated and dried with cotton and rouge.

Second Preparation.

5. Acidulated oil with rouge, for polishing the layer of gold and platinum :
6. Absolute alcohol, for removing, as much as possible, the oil and rouge :
7. Cyanide of mercury, employed cold, and rubbed only with cotton :
8. Oil rubbed very strongly, and equalised in the last place with rouge sprinkled on it.

On the fixed Proof.

1. Nitric acid at 36°F. with rouge for removing the stains :
2. Oil with rouge for removing the traces of the image and for polishing.

Continue then as above, setting out from No. 6, alcohol, &c.

On the unfixed Proof.

Alcohol with rouge for removing the traces of oil, and continuing as above, beginning from No. 6, alcohol, &c.

OBSERVATIONS.

On Iodising.—The color of the impression depends on the tint given to the metallic iodide ; it may, therefore, be varied at will. However, I have found the violet rose color most suitable.

For transmitting the iodine to the plate, the sheet of cardboard may be replaced by an earthenware plate deprived of enamel. The iodine transmitted by this means is not decomposed ; it is useless, I may even say injurious, to heat the plate before exposing it to the vapor of iodine.

Washing with Hyposulphite of Soda.—In order to remove the sensible layer, the solution of hyposulphite of soda must not be too strong, because it destroys the sharpness of the impression. 60 grammes of hyposulphite are sufficient for 1 quart of distilled water.

NEW INVESTIGATIONS CONCERNING THE COMPOSITION OF THE MUD OF THE RIVER NILE.

BY M. J. LASSAIGNE.*

The fertility of the soil in Egypt, in the plains which are annually inundated by the overflowing of the waters of the Nile, is due, as is known, to the peculiar mud which they deposit on it, and which, by mixing with the superficial layers of the sandy soil, thus renders the earth fit for various kinds of culture. The nature of this mud has been established by only one analysis, made in 1812 by M. Regnault, and published in the Memoirs of the Commission of Egypt. (*Histoire Naturelle*, t. ii., p. 405.) The investigations of this chemist tend to show that this mud, collected at 500 fathoms (974 m. 197), is composed of : water, 11 ; carbon, 9 ; oxide of iron, 6 ; silica, 4 ; carbonate of magnesia, 4 ; carbonate of lime, 18 ; alumina, 48. Being lately consulted by M. De Las Casas concerning the true composition of this mud, and the results enunciated in the foregoing work, I was obliged to make various researches in order to ascertain whether new experiments had been undertaken since the publication of M. Regnault's memoir, and I found, with surprise, that nothing had been published on this subject interesting to agriculturists. Consequently, M. de Gasparin, member of the Academy, having procured a small quantity of this mud, for which he was indebted to the kindness of his colleague at the Institute, M. Elie de Beaumont, I hastened to analyse it. This mud had the appearance and the brownish-yellow color of a fine argilo-ferruginous earth ; it adhered very slightly to the tongue, and had a soft and rather soapy feel. Dried at 212° F. for three hours, this mud, which had the appearance of a very dry earth, lost, nevertheless, 8·5 per cent. of its weight. Pressed between the fingers, it was easily reduced to powder ; and, when pieces of it were put into water at the ordinary temperature, it slightly increased in volume, and was converted into a thick pap, which, after having been drained of the excess of water interposed between its molecules, presented the plasticity of clay, it was kneaded, and became hard by the action of fire.

Before undertaking any chemical reaction on this mud, it appeared to me interesting to ascertain its density ; and, in order to avoid the hydratation of this muddy earth, in weighing it in distilled water by the means ordinarily employed for this purpose,

* *Comptes Rendus*, No. 17, April 22, 1844.

I made the experiment by weighing the mud, dried at 212° F., in pure alcohol, at 0·811 of density. By calculation, it was easy afterwards to reduce the density of this mud to that of distilled water.

The following are the data furnished by the experiment :—

Weight of dry mud.....	2 grs.	·50
Weight of the volume of alcohol displaced at the temperature of 59° F.	0	·85
Weight of the volume of distilled water, corresponding to that of the alcohol.	1	·048

$$x = \frac{2{\cdot}50}{1{\cdot}048} = 2{\cdot}385$$

By comparing the density of this portion of the mud of the Nile with the density of different simple and compound earths, such as those of which Schubler has given an example, it is remarked that it resembles, in this physical character, argils and good garden earth. (See *Cours D'Agriculture*, by M. de Gasparin, t. i., 2e partie., chapitre 1e., p. 153.)

CHEMICAL ANALYSIS.

A gramme of this mud, well dried at 212° F., having been calcined to redness in a platinum crucible, in contact with the air, lost, by this calcination, 0 gr. 135. This loss, as we ascertained by ulterior experiments, must be attributed to a portion of water which remains combined with it, and to a combustible matter, which was burnt by the oxygen of the air.

With the view of ascertaining whether this lime did not contain organic matter, whose presence is not noticed in the work of M. Regnault, I made several experiments, which enabled me to distinguish it by the following properties :—

I. A portion of this mud, heated in a glass tube two small strips of paper, the one colored blue, the other red, by litmus, being placed at the aperture of the tube, exhaled with the water which condensed in the upper part of the tube, an empyreumatic ammoniacal vapor, which restored the blue of the reddened litmus paper. After this calcination, effected out of contact with the air, the mud had acquired a very evident blackish tint, due, doubtless, to a portion of carbon, which the organic matter had abandoned by its decomposition.

II. Although the ammoniacal vapor produced in the foregoing calcination attested the presence of nitrogen among the elements of the organic matter, which I detected, I tried a new experiment, by heating with potassium in a tube a small quantity of dried mud. The product of this new calcination was dissolved in water, and the resulting solution, decanted from the insoluble earth, furnished with dentosulphate of iron and sulphuric acid, a bluish liquor, which precipitated flocks of Prussian blue. The formation of this compound, by proving the presence of cyanogen in the product of calcination, evidently demonstrates the pre-existence of nitrogen in the organic matter in question.

III. Another portion of mud, put in contact with separate weak solutions of potassa and ammonia, abandoned to them a brown organic matter, which dissolved at the ordinary temperature, imparting a color to them. This organic matter, extracted by the evaporation of the ammoniacal solution, was presented in the form of a brownish mass, which partially redissolved in cold water, abandoning a brown flocculent matter, capable of being redissolved in more concentrated alkaline solutions, and in hydrochloric acid. This brown matter is nitrogenous, as I ascertained by calcining it with potassium by the process which I have already made known in the preceding paragraph. The soluble extractiform portion, obtained by the maceration of the muddy earth in liquid ammonia, diluted with its own volume of water for 12 hours, contains, after having been dried, ammonia in combination, as was demonstrated by the action of potassa on it. This alkaline solution, saturated with hydrochloric acid, was turbid, and deposited brown flocks, which presented, by their sparing solubility in alcohol, by the soluble, brown and uncrystallisable combinations, which they form with potassa, soda, and ammonia, all the characters of ulmic acid existing in the vegetable earth, and the detritus of the decomposition of most organic substances.

The ulmic acid, which this action of alkaline solutions enabled me to detect in the mud of the Nile, exists in it mixed with the brown nitrogenous matter which I noticed above, and partially free and partly united with lime and a little ammonia. Indeed, by treating, cold, a portion of this mud, by a concentrated solution of potassa, there was developed a perceptible but weak disengagement of ammonia, which was distinguished by the odor and by the white vapors to which it gave rise, when a tube dipped in hydrochloric acid was brought near to it.

Moreover, the mud, treated at first by very weak hydrochloric acid, more readily yielded to liquid ammonia both the ulmic acid and the organic matter which it contains. The hydrochloric acid held in solution lime, a little oxide of manganese, oxide of iron, and a small quantity of brown organic matter.

DETERMINATION AND ESTIMATION OF THE INORGANIC OR MINERAL ELEMENTS OF THE MUD.

The proportion of the mineral principles forming the principal basis of the mud of the Nile, was established by following, with some modifications, the process adopted by M. Regnault, in the analysis which he published in 1812, which process, moreover, is that which is ordinarily followed in the analysis of rocks and stones.

Before employing it on the mud of the Nile, I thought it right to separate, by the successive action of hydrochloric acid and weak ammonia, all that these agents could extract from it; I was thus enabled to determine the small quantity of calcareous and organic matters mixed with the species of argillaceous earth, the basis of this mud.

With respect to the elements of this latter earth, I isolated them, by fusing with three times its weight of alcoholised potassa, in a silver crucible, a portion of mud previously calcined to redness. The fused mass which resulted was of a greenish-yellow color; treated with warm distilled water, it was afterwards dissolved by hydrochloric acid.

The solution evaporated to dryness left a white pulverulent residue, from which boiling water, acidulated by hydrochloric acid, separated silica in the pure state. Its weight was estimated, after having been heated to redness in a platinum crucible.

Ammonia, being afterwards poured into the liquor, from which the silica had been separated, produced an abundant yellowish and flocculent precipitate, composed of alumina and peroxide of iron in the state of hydrates. These two oxides were collected and treated by a boiling solution of caustic potassa, which dissolved the alumina, and separated the peroxide of iron. The latter, dissolved in pure sulphuric acid, furnished a solution which was evaporated to dryness; the residue which resulted from it, calcined at a red heat, left anhydrous peroxide of iron, which was washed with boiling water, in order to separate from it a little lime and magnesia, which it contained in the shape of sulphates.

The alumina was precipitated from its alkaline solution by exactly saturating the latter with an acid.

By summing up the facts observed in this work, I may conclude, that the portion of the mud of the Nile on which I operated was composed, after dessiccation at 212° F.:—

Silica (silicic acid)	42·50
Alumina	24·25
Peroxide of iron	13·65
Carbonate of lime	3·85
Carbonate of magnesia	1·20
Magnesia	1·05
Ulmic acid and nitrogenous organic matter	2·80
Water	10·70
Total ..	100·00

This new analysis, by rendering the composition of the mud of the Nile better known, which the results published in 1812 by M. Regnault had not established, proves that this very fertile alluvial earth is a true silicate of alumina, formed of 2 atoms of silica and 1 atom of alumina (Al. Si^2). The proportion of water which exists in this mud, dried at 212°F., would be partly united with this silicate, and partly with peroxide of iron.

The very remarkable presence of ulmic acid, and of a nitrogenous organic matter, in this mud, explains its advantages as a manure better than the carbon which M. Regnault admitted in it in 1812.

It is, however, probable that the good effects of the mud of the Nile, abandoned by the waters on the surface of the lands of Middle and Lower Egypt, are due to its amending the sandy constitution of the soil, and depositing on it a species of *mould* which it naturally contains.

ON THE COLORATION OF METALS.

BY M. BECQUEREL.*

SECOND MEMOIR.

(*Concluded from page* 221.)

[For the completion of this article, we are indebted to the *Electrical Magazine*, conducted by Mr. C. V. Walker.]

ON THE DIFFERENT ARRANGEMENTS TO BE ADOPTED IN ORDER TO OBTAIN UNIFORM OR VARIED TINTS ON THE SURFACES.

In order to obtain uniform tints, the object must be arranged so that the action of the current shall be the same on all points of the surface, without which there will be portions more covered with films of peroxide than others; hence arise prismatic colors or tints more or less varied on the same surface, producing an irisation, which would often spoil the picturesque effect. In order to have a single color, several conditions must be fulfilled, which depend on the chemical properties of currents, and on the skill of the operator.

* *Comptes Rendus*, No. 6, February 5, 1844.

1st. The deposits of peroxide must be successive and extremely thin, so as not to pass hurriedly from one color to another; that is, they must be arranged so as to have successively all the tints of each color: in this case, the only risk is that of having, on the same surface, tints closely approaching the same color. This is accomplished by taking, as negative electrodes, platinum wires of from 1 to $\frac{1}{10}$ millimètre in diameter. Each wire is introduced into the interior of a glass tube, one extremity of which is melted at the lamp, and the wire cut close to this extremity, so as to have beyond the tube a metal point, in a measure fixed, by which the current may pass out; in this way a current, produced by a very small quantity of electricity, may be made to circulate in the liquid. At the other extremity, the wire is fixed with mastic, and a certain length is given to it, so that it may be connected with the negative pole of the decomposing apparatus. A certain number of tubes, all connected with the pole, are thus prepared, so that the one, suited to the extent of surface experimented on, may be taken. The negative electrode being thus reduced to the smallest possible dimensions, for it can only present the section of an almost microscopical wire, the deposit of the films is gradual. It must be borne in mind, to remove, from time to time, the deposit of lead; which, however, is not considerable, when the action is slow.

Instead of one tube, which I may call a tube electrode, several are often united together, by cementing one to the other, so that all the points are in the same plain; or else, a certain number of platinum wires are introduced into the same tube, closing with the lamp the extremity by which they are to enter the solution. They are cut off at a certain distance from the tube, and are separated, so as to form an actual pencil.

2nd. The objects are connected with the positive pole of the apparatus; when they are only two or three centimètres in extent, they are merely attached to an iron or a copper wire, connected with that pole; or else, the object is held with an iron vice, connected with the apparatus, care being taken frequently to file the interior of the branches, in order to remove the peroxide which is deposited, and which, not being a conductor, would prevent the circulation of the current. If the object is of a certain extent, the connecting wire must be multiplied, so that the current may pass by a greater number of points. The object may also be seized with metal pincers, for changing its position, without which the connecting points could not acquire color. Finally, the more the number of points of contact is multiplied, the more does the deposit approach uniformity. If a square surface of small extent is operated on, a wire is attached to each angle. If the extent is considerable, the plate may be placed on two wires crossed at right angles, and passing by the middle of the sides. With a triangle, the three angles are placed in connection with the positive pole; with a circle, the connecting point must be at the centre. In fact, the law of symmetry, relative to the position of the connecting points, must be complied with; for this is the only means of rendering the decomposing action of the current uniform.

3rd. If a cylindrical ring is being operated on, the pincers are placed within it, and their branches are opened and kept apart by a wooden wedge; or else a conical mandril is introduced into the interior, which, by being more or less thrust in, allows the article to be fixed on the mandril, which is connected with the positive pole. If the cylinder is short, it is placed on a copper base or trellis, which is in constant connection with the positive pole, care being taken to wash away the deposited peroxide, by a means that we will presently point out. Thus far concerning the mode of connecting objects with the positive pole. I will now point out the mode of operating with the tube-electrode, in order to obtain uniformity or variety of tints.

This electrode must never be at rest; for the deposit would be always more abundant in the nearer points of the object. It is, then, indispensable to move it continually above the surface to be covered, keeping it always sensibly at the same distance, which must be greater as the surface of the objects is less. This is the only means of obtaining equality of distance between the metal point and all the points of the surface, since the oblique lines differ less and less from the perpendicular. This difference, however, is not so great in respect to intaglio and relief, which, without this precaution, would present differences in their coloration. When the bodies are of large dimensions, the point must be still further removed from the surface, and the movement of the tube electrode must be accelerated, so as to pass the point incessantly from the centre to the circumference, if a plain object is being operated on. There are cases in which the point must be removed 1 or 2 decimètres (4 to 8 in.) from the surface. One might think that, by employing solutions of plombate of potassa, more or less diluted, we might more surely attain the object in view, namely, a slow and successive coloration. Theory assuredly indicates this, but experiment proves the contrary; the best results are certainly those obtained with the

saturated solution of plombate of potassa, giving 24 or 25 degrees of Baumé's areometer, at common temperatures. With less saturated solutions, the colors have no brilliancy, and are so slow in forming, that a considerable time is required in order to arrive at all the successions of tint that are sought after. The vessel, in which the operations are carried on, must be of good dimensions in all directions, so as to give freedom for manipulation, and the power of removing the tube electrodes as far from the surface of the objects as may be deemed expedient, while the objects to be produced are themselves in sight.

The cylindrical form is the most suitable, because it permits of obtaining a regular action, by moving the tube electrode along its inner surface; when the objects are of large dimensions, the diameter of the vessel ought to be two or three times that of the objects themselves.

To fix the ideas as to the manner of manipulating with the tube electrode, I will quote some examples.

Suppose we wish to cover uniformly not only the upper surface of a square plate, but both surfaces; after having arranged a conductor at each of the four corners, the plate is placed horizontally in the solution, and the tube electrode is moved at a suitable distance from its edges, the point being constantly maintained at a level with the plate, and on the same plain, so that the action of the current may be the same above and below. If the article has larger dimensions, after having attached to it the requisite number of conductors, the simple tube electrode is not sufficient; there must be a tube electrode with two or with several branches, the wire of each of which leads to another in connection with the positive pole of the decomposing apparatus. I will first consider the tube with two branches, consisting of two tube electrodes cemented to each other, and passed into a cork so short that they may slide one over the other, in the direction of their length. The two closed ends are bent at a right angle, first to a distance, which must, at least, be equal to half the width of the object, and then at a little distance from the extremity, so that the two points may be placed relatively in the same line. The terminal branch needs not be more than half a centimètre long; the plate is placed between the two points, each surface being at the same distance from the point that faces it. This apparatus may be manipulated so as to present in succession each point equally opposite to all the corresponding points of each of the two surfaces. As the length of each fresh bend is equal to something more than half the width of the object, in order to reach all the points, nothing more is necessary than to turn the whole system round this object. We repeat, that the double or single electrode must be continually in motion, taking care that each point is always at an equal distance from the surface facing it; otherwise, the electrochemical action would be stronger on one side than on the other; this condition is fulfilled by means of the following arrangements:—On the upper edge of the vessel two small wooden tubes on rods are fixed parallel, and the object, if it is a square plate, is so placed, that two of the sides are at an equal distance from its edges. The lower boundary of the great bend of the upper tube is applied to one of these tubes; in this manner the two points are at an equal distance from the two surfaces. If we wish to operate regularly on a circular surface, the tube electrode is slid into the interior of an horizontal copper spiral, the summit of which corresponds with the centre of the circle, and all the points of which are equally distant from the upper surface of the object.

If we wish to color the interior of a hemispherical surface, its interior is filled with the solution, and the vessel is connected with the positive pole, by placing it on a copper plate connected with the said pole. The tube electrode is thrust in, so as to place its point in the centre of the section, and it is then left in a fixed position. In this case, the decomposing action of the current is the same on all points of the surface. With a cylindrical vessel, the tube electrode must be placed along the axis, and the point must be constantly carried up and down; if a sphere is the subject, the point must be placed in the centre, and fixed. The law of symmetry is seen to be regarded in all these arrangements.

In order to be sure of passing through all the intermediate tints, with the power of stopping, not only at the color, but even at the tint desired, the immersion of the tube electrode must not last beyond a few seconds, especially at the approach of that color or tint. The article is then removed from the bath; the state of coloration is examined; but, when the operation is over, it must immediately be washed in abundance of water; and a current of cold water must be allowed to fall on the article so as to remove the smallest particles of potash, which might very quickly alter the colors.

I have now to make known the method of operation in order to give a surface or a portion of a surface different colors, or tints of unequal intensity, as must be the case in coloring the leaves or other parts of a flower.

For this purpose, these two principles must be fundamental;—that the deposits formed on the boundary lines are the strongest, as are also the parts which are nearest to the point of the tube electrode. Nothing is more simple than, by the aid of these two principles, and by taking a certain number of connecting wires, to arrive at the end proposed.

Let us suppose a circle representing the horizontal projection of a rose, and that we wish to color the central part green; we begin by putting the tube electrode for some seconds above this part; the surface will be covered with a deposit, that will be stronger there than elsewhere. That being done, the tube is carried well away from its first position, that the action may be uniform throughout; green will be produced in the central part, while the lateral red portions will have a tint more uniform, as they are more distant from the centre. If shading is desired, the tube electrode is moved on, describing sensibly a spiral, which shall terminate in the centre. Having a certain degree of skill, we may succeed, by means of the tube electrodes, in *painting* a simple or compound flower, with all its shades; so that these tubes may, to a certain extent, be compared with pencils. The perfection of the effects produced depends, 1st,—on the electro-chemical knowledge of the operator; 2nd,—on his skill; 3rd,—on his artistic talents.

The colored objects that I have the honor of submitting to the Academy, although not uniting all the qualities which electro-chemical coloring may one day present, will, however, give an idea of the advantage which the artisan may derive from an art, the general principles of which I have here explained.

I omit a host of details, which the operator will easily discover, when he has acquired a certain degree of skill in the manipulations.

When an article fails, nothing is more simple than to remove the films of peroxide; it must be plunged, for a few moments, in dilute acetic acid, in order to decompose the peroxide and dissolve the protoxide; the surface must then be brushed, and afterwards washed.

OF THE DECOMPOSING APPARATUS.

In order to obtain all the effects, which have just been described, a decomposing apparatus must be employed, which gives a current sensibly constant during the whole of the operations. It must be easy to manage; and I have found nothing better than pairs, consisting of a copper cylinder 1 decimètre (4 in.) in diameter, and 1½ in height, and a solid zinc cylinder 2 or 3 centimètres in diameter, previously amalgamated and surrounded by the former; each pair is placed in a cylindrical glass jar, and connected with the next in series, by means of the usual arrangements. The battery is charged with water, containing about $\frac{1}{100}$ of sulphuric acid. Six pairs are generally sufficient for all operations. A less number may be employed; but the most satisfactory results have been given me with this number.

The conducting wire, as well as the different connecting parts, must be very clean, in order to avoid irregularities in the action of the current, which would annoy the operator.

We discover if the current has too high an intensity, when, instead of the anhydrous peroxide, the yellow hydrated peroxide makes its appearance; this must then be remedied, for all coloration ceases.

ON THE ALTERATION OF COLORS, AND THE MEANS OF PREVENTING IT.

Do the colors produced by the deposit of thin films of peroxide of lead alter in the air more or less readily, according to the methods by which they are deposited? This is an important point to examine, in connection with the applications to the arts. I will point out the causes by which this alteration is brought about, as well as those which may prevent it, or at least reduce the effects. The observations, which I am about to present, have reference to coloring on gold; because that is produced by successive colored films of peroxide of lead only, not mingled or combined with other oxides.

All causes which decompose peroxide of lead necessarily alter this substance; thus the acids and the alkalies make the peroxide pass to a lower state of oxidation, in order that they may combine with the protoxide. We must, therefore, avoid leaving the colored objects exposed to acid or ammoniacal exhalations, which, by decomposing the peroxide of lead, alter the colors. The only means of preventing the contact of acid or ammoniacal exhalations, is to place the objects under glass, or to cover their surface with a transparent, durable varnish, which, while opposing the action of vapors, alters their color in the least possible degree.

I have made a great many experiments on this subject, which it is needless to relate here, in order to study the qualities of all the varnishes, which were at my disposal. The principal facts that I observed are these:—The best varnish would undoubtedly be that which, being saturated with oxygen, would not take any from the body that it covers. Now no varnish possesses this property; we are, therefore, forced to take that which is the least alterable in air.

We may distinguish four kinds of varnish:

—1st, Alcohol varnish; 2nd, Essence of turpentine varnish; 3rd, Linseed oil varnish; and, 4th, Essence of turpentine varnish; the resins, employed to make the first two, being either gum lac or gum copal. The first three varnishes are not suitable; for they it is which alter the colors most. The fourth also alters them, but in a less degree, especially when it is saturated with litharge; because it has then less disposition to react on the peroxide. The composition of this varnish is as follows:—In a varnished pot is placed ½ a litre (30 cub. in.) of linseed oil, from 4 to 8 grammes (61¾ to 123½ grs. troy) of litharge, finely pounded, and 2 grammes of sulphate of zinc; a moderate heat is applied for several hours. When the solution of the oxide of lead is accomplished, it is filtered to separate the excess of litharge. If the oil is too thick, it is dissolved in essence of turpentine, which has been previously boiled in a retort on the litharge, so as to take away the succinic acid, which might be there, and which would alter the colors. The varnish being prepared, it is spread on the article with a pencil, in a very thin layer, and is dried at a low temperature. When the article is very dry, a second layer is placed on, which is dried in a similar manner. On the first application of the varnish, the following effects are observed:—The blue of the second order disappears, so that the bluish green becomes yellowish green; the yellow and the red undergo very little change. With regard to the colors of the third order, especially the deep green, they remain almost untouched.

So that, by means of the varnish, the articles are entirely preserved. When we desire to obtain and to preserve the colors of the second order, with the exception of bluish green and grass green, the instant that bluish green is passed, and yellowish green begins to appear, we must stop the operation, wash, dry and put on the varnish; the color is then preserved. I should mention that, as this varnish does not possess perfect transparency, since it is brownish colored, the colors lose their brilliancy, but gain in solidity. It may be asked, Why are the colors of the third order more easily preserved than those of the second, and especially than those of the first? We might imagine that the layers of peroxide, being thicker, are more easily preserved; but then, as the first layer disappears, the preceding layer ought to be seen, which does not appear to be the case. Moreover, the disappearance of the blue of the second order, points out a peculiar action of the varnish, of which it is difficult to give an *à priori* explanation. I say an *à priori;* because the films of oxide of lead are so fine, that the effects which are produced cannot be analysed. We can only observe these effects, and describe them by resting on the data with which physics and chemistry furnish us. MM. Lefranc (clever varnish makers) have been kind enough to prepare for me a thick varnish of gum copal, which, in place of altering the blue produced on platinised copper, gives it, on the contrary, greater brilliancy, at least, in certain tints. This varnish is the most durable known.

ON THE COLORING OF ARTICLES OF COPPER, PLATINUM, SILVER, GERMAN-SILVER, BRASS, IRON OR STEEL.

All the effects of coloring, which I have just described, have been produced on gold or on gilded copper; these effects take place, whatever be the extent of the surfaces; but it is not the same with brass, and sometimes with copper, there occurs, at the commencement, a phenomenon, with the cause of which I am not acquainted, although I have devised a means of guarding against it.

Brass.—When the article is small (having 1 or 2 centimètres of surface), the coloring occurs as soon as the circuit is closed, and the more rapidly, as the surface is smaller; but, when it is larger, the article remains brilliant for a long time, and even preserves its brilliancy. The surface is then found in a passive state, analogous to that which iron is made to acquire by various means; for no coloring effect takes place. Is this apparent state of passivity, which is, in a similar manner, possessed by other metals, due to a simple deposit of oxygen on the surface, or to a film of oxide of copper, which is formed before the formation of the peroxide of lead? The facts which follow furnish a glimpse at the phenomenon. The apparent state of passivity is indicated by an abundant deposit of lead on the negative electrode, which is easily explained, since there is no peroxide formed.

Experiment having taught that a very small surface is colored immediately, it follows that it acquires the necessary modification for that phenomenon to take place. That being established, large surfaces of brass may be made to acquire this modification, so that coloring may take place as upon smaller surfaces. For this purpose, a small portion of the surface must be first plunged into the alkaline solution, which becomes colored immediately, and the neighboring parts must continue to be immersed, until the whole article is in contact with the liquid.

The modification which the article then acquires is indicated by a fugitive cloud, that covers the entire surface, and the color of which cannot be defined, so fugitive is it;

but what there is peculiar and no less astonishing is, that the part first plunged in, which is almost entirely colored, loses its color, and apparently regains that of the metal, without there being a possibility of recoloring it again; when once the cloud has spread like a shade over the whole surface, in a few moments all the phases of coloring are produced, such as they have been previously described, and the colors of which rival in brilliancy the best of those afforded us by the most polished gold. The inquiry, as we well know here, bears only on the coloring analogous to that obtained on gold and on gilt copper, and not on coloring, the tints of which present a vinous aspect, which is obtained on large articles that have remained a long time under experiment.

When we wish to color an article having certain dimensions, by following the directions that I have now laid down, it is placed on an inclined plane, which is plunged into the solution, and down the length of which it is made slowly to descend. By means of this arrangement, only a small portion of the surface, that has not yet been subjected to voltaic action, is in contact with the liquid at each moment. We might be induced to think, in consequence of the effects which are produced, that, if the dimensions of the negative electrode were increased, a great surface might speedily be rendered active; but such is not the case; for, whether this electrode be great or small, the positive surface, when it has a certain extent, always remains passive; so that, to render it active, the means I have just pointed out must be pursued. With regard to the true cause of the phenomenon, I have not yet perceived it; simply, as the colors are more stable on brass than on gold, it is probable that a combination, or perhaps a mixture, is formed of oxide of copper and peroxide of lead, which further researches may discover. Meanwhile, I must mention that, among the colors obtained, there is, in the second order, a gold yellow, comparable to that of gold; and which even, in some cases, appears identical.

Copper also sometimes acquires the passive state; but less frequently so than brass.

Silver is never passive, when its surface is prepared, by following all the indications that I have given; but its coloring does not in any way resemble that of the other metals, although the different orders of rings may be followed; seeing that this metal speedily undergoes an oxidation, which gives a vinous yellowish tinge to all the colors; when the surface is perfectly polished, and the current is not intense enough to produce any sensible alteration in the silver, very vivid colors may be obtained.

Platinum, and especially platinated copper, become colored with the richest blues that, I think, art can produce. Every thing induces a belief that the oxidation of the platinum is concerned in producing these colors, which would be the result of the combination or mixture of oxide of platinum and peroxide of lead; this point must be treated on hereafter. Although blue is the leading color, nevertheless several colors of the different series of colored rings are obtained. The violets and the blues that are found among the objects, which I have the honor of presenting to the Academy, will, I think, show how greatly the blue in question approaches that of natural flowers.

German silver, dry-rubbed with very fine pounce and a brush, colors very well, without its surface becoming passive, at least in the great majority of cases. When its surface is polished, very beautiful colors may be developed.

Polished steel is easily colored, when its surface has been properly prepared. We obtain the different tints, which it acquires when heated, over and above the tones, which depend on the successive deposits of films of peroxide.

CONCLUSION.

The details into which I have entered, both on the analysis of the effects of coloring, as well as on the practical means, by aid of which it may be applied in the arts, are sufficient, I hope, to enable those who wish to undertake it, to do so without experiencing any very great difficulties. In concluding, I may compare the effects that I have observed with Nobili's electro-chemical rings, which I mentioned at the commencement of this memoir, confining myself especially to those which he obtained with acetate of lead, purposing to examine, in another memoir, the effects which result from the action of other solutions. To obtain the concentric colored rings, more or less compacted, on a plate of gold rendered positive, Nobili employed a neutral or almost neutral solution of acetate of lead. He has faithfully reported this fact, without seeking to explain it. These rings must have speedily disappeared, as soon as the acetic acid became free, on account of the reaction, which this acid exercises on the acetate of lead. My mode of experimenting, and the effects which are obtained, are different. The solution which I employ is alkaline, and can be no other, because it is necessary that the oxide of lead, carried to the positive pole and peroxidizing, should play the part of an acid, in respect to the potassa; in order

that the adhesion may be as strong as possible, which could not be the case if we operated with acetate of lead, or with any other salt of lead, because the oxide acts the part of a base. On the other hand, there are always colored rings in Nobili's experiments, whilst, in my mode of experiment, uniform tints may be obtained on surfaces of a certain extent, which are durable, and very adhesive. Nobili sought after colored rings; I have avoided them. There is really nothing in common between Nobili's electro-chemical colored rings, and the phenomena of coloring here in question, except in that both are produced by thin films.

In a third memoir, I shall explain the effects obtained by operating on plates of copper or other metal, covered with a metallic film or oxide, so as to show the extent to which the effects, which have been described, may be varied; in fact, I will omit nothing which may throw light on the new art, the foundation of which I desire to lay.

CHEMICAL INVESTIGATION CONCERNING A MINE OF MANGANESE FOUND NEAR GIESSEN.*

BY DR. C. ETTLING.

In the year 1841, Mr. Briel, advocate to the Court, discovered a mine of manganese in the vicinity of Giessen, remarkable for its richness, and for the facility with which the manganese may be obtained, as well as for the manner in which it occurs. In other mines the manganese is found in the midst of porphyry, or other hard stones, which render its extraction expensive; but here it exists at an inconsiderable depth, in a layer of ferruginous plastic clay, on dolomite, which covers the secondary limestone that occurs near Giessen. Immediately above the dolomite is found a layer of wad, 1 to 1½ feet thick, which is light and very brittle, containing a little clay, and over that there is a layer of red plastic clay, one foot thick, free from manganese; these two layers are in several places separated by some pipe-clay of a snowy white, several inches thick. Upon this clay is another layer of clay, from 6 to 8 feet thick, in which the manganese is disseminated in masses, sometimes even so near to one another, that it seems to form a real layer. In the middle of this clay is a layer of fine manganese (Braunsteinmulm) 1 to 1½ feet thick. Immediately over the clay which contains the manganese rests the plastic ferruginous clay, forming the superior free surface of the mine, which in some places, close to the manganese, contains so much iron that it offers the characters of the (Thoneisenstein) brown iron ore (siderus hæmaticus). As it is in the case of other mines of manganese, so is it with this: several ores of manganese are found together, especially in the *nests*, in which the pyrolusite (Weichmanganerz) is predominant, some psilomelanite, accompanied by small druses of sulphate of baryta, is found.

Though care be taken in the mines, and afterwards out of them, to separate the ores which are mixed during the work from the pyrolusite, yet is there no possibility of entirely succeeding, when, as in our case, the mineral is to be sorted for a sale, amounting to several thousand hundredweights. Hence several sorts of manganese are obtained, of which the purchaser ought to choose that which best answers his purpose.

Mr. Briel requested me to subject the different sorts of this manganese to a chemical investigation, in order to assist purchasers in the selection; it being, however, understood that it is not intended fully to determine the respective quantities of all the kinds of manganese, but merely as far as it is necessary to ascertain the value which they have for the manufacturer of chloride of lime, the bleacher, druggist, &c.

This value is in a direct ratio with the quantity of chlorine gas which a certain quantity of manganese can disengage from hydrochloric acid or from common salt and hydrated sulphuric acid, and depends, besides this, essentially upon the amount of hydrochloric acid, or common salt and hydrated sulphuric acid, requisite to obtain the desired quantity of chlorine gas, by means of a given sort of manganese.

For instance: by means of 1 kilogramme of the purest manganese we could obtain 810·9 grms., or 255·7 litres of chlorine gas, and to accomplish this, 1667·5 grms. of anhydrous muriatic acid are necessary (which is equal to 5503·2 grms. of muriatic acid of 1·15 sp. gr., which is usually met with in commerce), half of which is decomposed into

* Since the discovery of the mine of manganese near Giessen, we have made use of no other in the laboratory of our University, it being of the same quality, and even easier and more completely soluble in muriatic acid, than that of Ilmenau. The analyses instituted by Dr. Ettling with care and exactitude, give full information on the value of the different sorts, and a conscientious sorting of the different kinds of manganese found there may be expected from Mr. Briel, the proprietor of the mine.

chlorine, and the other half remains combined with the manganese in the retort. Suppose one kilogramme of the purest manganese to cost 12 kr. (4d.), and one kilogramme of muriatic acid 1·15 sp. gr. to cost 10 kr. (3½d.), the expenses for the chlorine gas obtained by them will amount to 55 kr. (18½d.), besides the charges for the manufacturing. But in the case of an impure manganese, which might be composed of ½ pyrolusite, ⅛ psilome, lanite, or compact manganese (dichtes Schwarzmanganerz), ⅛ manganite, ⅛ oxide of iron, $\frac{1}{16}$ clay, $\frac{1}{16}$ limestone, the result would be the following :—

½ kil. pyrolusite	requires	833·75gr.	anhydrous muriatic acid, and yields	405·45gr. chlorine
⅛ psilomelanite	,,	113·59		29·46 ,,
⅛ manganite	,,	154·59		50·12 ,,
⅛ oxide of iron	,,	174·43	} give no chlorine.	
$\frac{1}{16}$ clay	,,	132·86		
$\frac{1}{16}$ limestone	,,	44·97		
1 manganese	,,	1454·19		485·03 ,,

These 1454·19 grms. anhydrous acid are contained in 4799·3 grms. muriatic acid of commerce of 1·15 sp. gr. or 19° Baumé, and cost (at 10 kr. the kilogramme) 48 kr. (16d.), and if the manganese is supposed to cost 6 kr. (2d.) the kilogramme, then, though it yields more than half as much chlorine as the pure pyrolusite gave, there will be an expense of 54 kr. (18d.), and the chlorine obtained will be worth only 32·9 kr. (11d.) To obtain, therefore, the same amount of chlorine, viz., 255·7 litres, an outlay of 69·19 kr. (23d.) will be required, consequently, by substituting the inferior sort for the pyrolusite, a loss of 36·29 kr. (12d.) is incurred ; and, besides the foreign substances augmenting so considerably the weight, will in the same ratio occasion a higher freight, and render the extraction of the chlorine more difficult.

If, instead of muriatic acid, common salt with sulphuric acid be made use of for the extraction of the chlorine, the expenses with the two different sorts of manganese would respectively remain unaltered.

Before I pass on to the examination of the sorts of manganese, I will remark that I analysed them all qualitatively. With the exception of the pure crystallised pyrolusite (Braunsteinstuff) they all contain oxide of iron, clay, silica, carbonate of lime, and magnesia, sulphate of baryta, baryta, and water ; yet, that all these impurities amount to but little, will be apparent by assaying for chlorine.

I adopted Gay Lussac's* method, which I prefer to any other. And though I am aware that it is known to manufacturers of chloride of lime, bleachers, and druggists, yet I will give it here, with the view of making some remarks on it, which may be acceptable to some.

Gay Lussac's method consists in directing into milk of lime the chlorine gas disengaged from a given quantity of hydrochloric acid by 3·909* grms. of manganese, and then —

1. The amount of chlorine contained in the bleaching liquid is to be ascertained by a chlorometrical process.

2. The remaining solution of manganese is to be examined, making out, by an acidimetrical process, how much free hydrochloric acid is left, and, consequently, inquiring how much of this acid was fixed by the manganese of the ores, and the other metals. 3·909 grms. of the purest pyrolusite yield 1 litre of the bleaching liquid, which contains exactly the same volume of chlorine gas at 32°F. temperature, and 28 inches (30 in. English) atmospheric pressure (or 3·17017 grms. by weight). If this be the case, it is considered of 100 degrees, and the manganese by which the chloride of lime is prepared, is called one of 100 deg. But if, on examining one litre of the bleaching liquid obtained by 3·909 grms. of some other sort of manganese, it appears that the volume of the chlorine gas therein contained be less—for instance, half a litre—the liquid is only of 50 degrees, and the manganese will be considered as one of 50 degrees, because, taken at the same weight with the pure manganese, it could only disengage half the quantity of chlorine from the muriatic acid.

But, as has been shown in the above example, the value of the manganese depends also on the amount of hydrochloric acid employed. 3·909 grms. of the purest pyrolusite transform exactly 6·5191 grms. of anhydrous muriatic acid (=175·79 acidimetrical degrees) into chlorine, but only half of which quantity is obtained, the other half remaining in the glass vessel combined with the manganese. If more than 6·5191 grms. of the anhydrous muriatic acid be employed, for instance 12 grms., then the surplus 5·4809 must remain in the free state, and on adding to the remaining solution of the man-

* Vide *Annalen der Pharmacie*, vol. xviii. p. 49.

* In the instruction given originally by Gay Lussac it is misprinted 3·980 grms.

ganese so much of an alkali as corresponds to 5·4809 grms. of the acid, no precipitate of the protoxide of manganese ought to be thrown down. If 3·909 grms. of the manganese under examination, on being treated with fuming hydrochloric acid containing 12 grms. of the anhydrous acid, furnish one litre of chloride of lime of 50°, then 3·2595 grms. anhydrous acid have been consumed for the production of the chlorine; and if, on examining the solution of the manganese, it appears that only 4 grms. of the acid in its free state be contained in it, then we miss on the whole still 4·7405 grms., therefore 1·481 grms. more than corresponds to 50° chlorine, which the manganese yielded. The manganese under examination contains, then, other ores of manganese, and, perhaps, foreign metallic oxides likewise; yet by the experiment we are enabled to calculate the price of the chlorine to be obtained by the manganese employed, it being, however, unimportant by what sort of metallic oxides the larger amount of muriatic acid, or of common salt with sulphuric acid, became necessary.

The assay is to be performed in the following manner:—The manganese is to be reduced to the state of a fine powder, out of which 3·909 grms. are to be put into a phial with double the quantity of fuming muriatic acid required for its solution, the amount of anhydrous acid contained in which being known, a long and narrow tube intended for the disengagement of gases is immediately after to be adapted, by which the chlorine, which directly rises, is conducted into ½—¾ litres of milk of lime contained in a phial provided with a large neck, or rather in a retort placed in an inverted position (as advised by Professor Liebig in the case of liquids to be saturated by gases), in such a manner that the chlorine arrives in its belly. The absorption of the chlorine may be promoted by gently shaking, and the disengagement of the same gas may be facilitated by applying a gentle heat, as, for instance, by immersing into water of 122°—140° F., which, towards the close of the operation, may be still hotter; and when chlorine is no longer disengaged, the heat is to be augmented so as to boil the solution of the manganese, in order to expel all the chlorine; but this must be discontinued, and the apparatus dismounted; as soon as bubbles of chlorine cease to appear, the disengaging tube becomes hot, for otherwise the whole of the muriatic acid would distil over.

The chloride of lime obtained is to be thrown into a vessel, which, up to a certain mark, contains exactly one litre, the retort rinsed with water, and this water added to the chloride of lime; next, the vessel filled up to the mark with water; and the whole, after having been well mixed, allowed to deposit previous to the assaying for chlorine.

Care is to be taken not to expose the chloride of lime to the rays of the sun, for then it would appear to be stronger than it is in reality (Vide *Annalen der Chem. und Pharm.* Bd. xxxix. p. 124). The solution of manganese ought not to exhale the odor of chlorine, and if there be any residue left undissolved, it should be colorless. Generally, it is sulphate of baryta, or sand; sometimes, undecomposed clay. It is instantly to be mixed with nearly an equal bulk of water, adding to it the muriatic acid washed off from the inner sides of the disengaging tube, after, however, having wiped away, closing the tube with the finger, the chloride of lime which adhered to its outer sides; then, if required, it is to be filtered, the filter washed, and finally saturated with an alkali. The muriatic acid employed in this assay must be fuming, and free from sulphurous acid and chlorine. In Liebig, Poggendorf, and Wöhler's *Handwörterb. der Chemie*, Dr. Moldenhauer advised that the acids should not contain more than 18 per cent. of the anhydrous acid; probably he meant that, during the disengagement of the chlorine, too much should not evaporate; but an acid of this kind, even if double the quantity required be taken, acts but slowly on the manganese, and, to make it dissolve, it is necessary to boil for a long time, when more muriatic acid will distil over contrary to what was intended. I repeatedly experimented with 3·909 grammes of manganese of 97·1 degrees, which, after having carefully reduced to the state of a fine powder, I put in 82·75 grammes muriatic acid containing 11·879 grammes, consequently, 14·38 per cent. of the anhydrous acid; and after having allowed it to stand at the temperature of 144½—167°F. for one hour, let it boil for a quarter of an hour, without being able completely to dissolve the manganese; whereas, on employing an acid of double the strength, the disengagement of the chlorine began already at the common temperature; and at a temperature of 144½-167°F., in less than half an hour it was so far advanced that a very little ebullition was sufficient to expel the remainder of the chlorine from the solution.

For the following experiments I prepared the muriatic acid according to the very easy method recommended by Gregory (Vide *Annalen der Chem. und Pharm.*, vol. xli. p. 375); and for the measuring I made use of a little syphon, which I made by drawing out a glass tube at both ends in two long

points, providing the one with a mark by means of a file. (To prevent the vapors exhaled by the acid entering the mouth during the suction, it is convenient to attach to it a little glass tube, containing a loose cotton ball, moistened by some solution of potassa.) Filled up to the mark it allowed to escape exactly 41·375 grammes of acid, the portion that adhered to the tube not being taken into account. 5·323 grammes of that acid (the sp. gr. of which = 1·1448 = 18½ Baumé), on being treated with a solution of silver, threw down 6·025 chloride of silver, = 1·5283 grammes anhydrous acid; hence, calculation shows that 41·375 grammes of acid made use of in each experiment contained 11·879 grammes, or 28·71 per cent. of the anhydrous acid, or 320·34 acidimetrical degrees.

This method, intended to ascertain the degree of concentration of the acid, requires some dexterity in chemical manipulation, but is, at the same time, the safest; it could, however, likewise be pretty accurately examined by saturating with a solution of soda, where the amount of the salt contained is known; it can easily be procured by converting the bicarbonate of soda into the carbonate by means of heat, weighing a portion of it, and dissolving in a determined quantity of water.

The neutral state of the acid can easily be ascertained by means of litmus, but with still greater accuracy if, towards the end of the saturation, the liquid be allowed to boil; and after having thrown in it a trace of the neutral solution of oxide of iron, the solution of soda is added by drops as long as the oxide of iron produces a feeble turbidness, which, notwithstanding shaking and continued boiling, disappears no more.

The solution of manganese obtained on assaying the manganese must be examined in the same way; it must be boiled, on drawing to the close, to expel the carbonic acid, which, even in presence of an excess of soda, would retain the protoxide of manganese in solution.

It may happen that a liquid saturated at the common temperature will be still entirely limpid, or, if containing chloride of iron, be of a light yellow color (containing consequently besides the carbonate of the protoxide of manganese some chloride of iron in its undecomposed state); and after the last drop of the solution of soda has been added throws down a white precipitate of carbonate of protoxide of manganese, and furnishes on boiling a copious precipitate of oxide of iron. To assay acids, and especially muriatic acid, by putting a piece of calc spar or marble in it, gives neither an expeditious nor an accurate result, for lime, when in lumps, does not neutralise acids before the lapse of a longer time. I dried a lump of calc spar, and after having carefully weighed it, allowed it to remain for four hours in one measure of the above-named acid (= 11·879 anhydrous acid, and = 320·34°) being previously diluted with 50 cubic centimètres water, at a common temperature; and as it did not become neutral, I let it stand again, for three hours, in a water-bath, after which time an addition of 1° of the solution of soda threw down no precipitate. 16·3175 grms. = 316·65 acidimetrical degrees of the calc spar were dissolved. The calc spar did not therefore indicate 3·69° acid = 1·15 per cent., out of which 2·69 evaporated, for they could not be discovered by the soda.

In a similar experiment a lump of marble did not indicate 3·09° acid, and in a third experiment a lump of calc spar, after having been allowed to remain for six days in the same acid, at a common temperature, did not indicate 5·37° = 1·676 per cent.

It is evident that the error will be greater if feeble acids, as, for instance, acetic acid, which contains only from 4 to 8 per cent. of anhydrous acid, were to be assayed by lumps of calc spar. In this case, Otto's method, which consists in the use of ammonia, is certainly preferable.

To assay the solution of manganese lime ought not to be used, for it throws down the iron, which manganese almost always contains, and sometimes even in considerable quantities.

With regard to the assay of the chloride of lime, I refer to Gay Lussac's instructions, merely remarking, that I made use of the solution of arsenic in muriatic acid, which is very sure, and less dangerous than some are inclined to think. The normal liquid is easier to be produced than that of a solution of potassa, for the arsenic is generally met with in a pure state in commerce. We have merely to pick out several colorless and transparent lumps, reduce them to powder, dissolving 4·439 grms. of them in diluted muriatic acid, to which sufficient water is to be added for the whole to amount exactly to one litre, and we obtain a liquid fit for all chlorometrical assays, where absolute exactitude is not required. I am aware of complaints having been made, that it is difficult to provide the necessary graduated glass vessels: they may be had at Mr. Collardeau's, Rue Fauxbourg St. Martin, No. 64, in Paris, where the instruments are most carefully made, according to Gay Lussac's directions. Under the name of *chloromètre of Gay Lussac*, all that is required, together with the instruction how to use it, is sold for 27 francs and 50 cents (= 1*l.* 2s.), and

under the name of *alkalimètre of G. L.* all the apparatus and weights required for alkalimetry and acidimetry, with instruction, is sold for 25 francs (=1*l.*). The different sorts of manganese destined to be assayed I generally took myself, except in the cases where it is expressly stated to the contrary, and proceeded in the following way :—

Out of a heap of from 200 to 300 cwts., I took at different places 4 to 6 shovels, holding each $\frac{1}{8}$ cwt., and ground it by a mill-stone, passing through a sieve, mixing carefully : from this the portions to be assayed were taken. The samples to be assayed were then reduced to a still finer powder, and immediately closed in glasses, to keep them in that dry state in which the manganese is on being put in barrels for commerce.

FIRST SORT—BRAUNSTEINSTUFF.

It is found in lumps varying from one or several half ounces to $\frac{1}{8}$ cwt., with all the mineralogical characters of pyrolisusite. It generally crystallised, offering radiated fibres, but occurs also sometimes in large lumps, easily to be crushed by the hands, offering an aggregate of small scales of pyrolusite. The solution contains no iron; on being treated with sulphuric acid, throws down no precipitate, and no residue is left. 3·909 grms. treated with one measure of muriatic acid=320·34°, yielded in several assays constantly—

97·1° chlorine=	169·69° muriatic acid
Required solution of soda	146·76°
Hence less or more acid combined ..	3·89°
	320·34°

Two counter assays, with a piece of a most beautifully radiated crystallised manganese of Ilmenau, taken from my collection, yielded—

I.

98·13° chlorine=	172·5° muriatic acid
	148·7° soda
	5·1° loss
	320·3°

II.

97·1° chlorine=	169·69° chlorine
	146·00° soda
	4·65° loss
	320·34°

These samples of manganese gave no vestige either of baryta or of iron, but, on being dissolved, they left some light, white flakes.

SECOND SORT—DERBER BRAUNSTEIN. COMPACT MANGANESE.

The lumps it offers are larger, and of a harder consistence; the fracture exhibits small grains, sometimes presenting a lustre, containing in some places psilomelanite, in others druses of sulphate of baryta. The lumps are frequently covered by a thin coating of the ferruginous clay, which Mr. Briel intends to remove by washing in an establishment to be erected. On being dissolved, it leaves some sulphate of baryta. A sample taken out of a heap of about 200 cwts. gave, in four experiments, constantly :—

a. 80·3° chlorine=	141·16° muriatic acid
	149·20° soda
	29·98° less or more acid combined
	320·34°

On assaying a sample taken out of a heap of 1,200 cwts. which were worked out at a later period, I found :—

b. 84·0° chlorine=	147·6° muriatic acid
	156·04° soda
	16·70° loss
	320·34°

Mr. Briel sent me afterwards another sample, which he took, in the manner indicated above, out of a third heap, 10 cwts. of which he ordered to be ground.

The result was the following :—

c. 87·12° chlorine=	153·14° muriatic acid
	147·80° soda
	19·40° loss
	320·34°

On dissolving 3·909 grms. of it, there were left 0·065 grms. sulphate of baryta, sand and clay amounting to 1·66 p. ct.; and 6·792 grms. of the same manganese, heated in a Liebig's apparatus for the analysis of organic matters till some oxygen appeared, gave out 0·186 grms. of water=2·743 per cent. With the supposition that this sort would be considerably improved if the first portion, which contained more clay, were to be separated by sifting previous to being ground a second time, Mr. Briel made the experiment with 10 cwts. The portions first separated by the sieve gave :—

86·92° chlorine=	152·8° muriatic acid
	146·3° soda
	21·2° loss
	320·3°

On being dissolved, there remained a residue of 0·064 grms. = 1·6 per cent. The portions last separated by sifting, gave :—

88·08° chlorine = 154·88° muriatic acid
148·28° soda
17·18° loss

320·34°

On dissolving, there was a residue left of 0·004 grms. = 0·1 per cent.

From this it appears that the sort was indeed improved by being thus divided by sifting.

THIRD SORT—BRAUNSTEINMULM, OR EARTHY MANGANESE.

This sort, as has been stated in the introduction to the present article, forms a layer situated in the plastic clay. It is easily worked out in great quantities; the miner can get hold of it with his hands. It occurs in groups of little scales of pyrolusite, and, on being crushed by the hands, yields a brownish-black powder, glistening in the sun's rays. On being sifted, there remain small lumps, presenting radiated crystals of pyrolusite. The sample was taken out of a heap of about 300 cwt. On being dissolved, a trifling residue was left, and the limpid solution, on being treated with sulphuric acid, produced but an inconsiderable turbidness, consisting of sulphate of baryta; hence the conclusion, that this sort contains but very little psilomelanite, and the larger amount of acid required be attributable to the clay and iron present. 7·426 grms. gave 0·4155 water = 5·59 per cent.

On being assayed, it yielded—

74·36° chlorine = 130·72° muriatic acid
157·79° soda
31·83° loss

320·34°

A sample taken from another heap, sent by Mr. Briel, gave 74·94 chlorine.

FOURTH SORT—WAD, OR WADARTIGER BRAUNSTEIN.

This peculiar sort forms, as above stated, the lowest layer close upon the dolomite. It presents reddish-brown or bluish-black lumps of an earthy fracture, containing a great number of druses, which seem to be pyrolusite in pseudomorphoses of bitter spar. The powder is black-brown, without lustre. A sample taken from a heap of 400 cwt. yielded

58·8° chlorine = 103·37° muriatic acid
186·01° soda
30·96° loss

320·34°

It is evident that even this sort may be turned to useful purposes.

On comparing these assays with each other, the following results:—

3·909 grms.	Yield chlorine.	Consumed on the whole of muriatic acid.
I.	97·1°	173·58°
II. average of *a*, *b*, & *c*.	83·8°	169·33°
III.	74·36°	162·55°
IV.	58·8°	134·33°

Or, to make 1000 litres of chlorine gas, there are required of the manganese of the four sorts, and of anhydrous muriatic acid, or muriatic acid of commerce of 1·15 sp. gr. = 19° Baumé.

Number of the Manganese.	Anhydrous Muriatic Acid.		Muriatic Acid.
	Kil.	Deg.	Kil.
I.	4·025 ..	178·764 = 6·629 =	21·879
II.	4·665 ..	202·064 = 7·493 =	24·730
III.	5·257 ..	218·598 = 8·106 =	26·754
IV.	6·648 ..	228·452 = 8·472 =	27·960

If it is intended, on producing 1000 litres of chlorine, to make use of common salt, and sulphuric acid instead of muriatic acid, which is the usual way of operating, then the first is to be calculated by the chlorine, and the latter by the anhydrous muriatic acid. 1000 litres of chlorine gas weigh, at 32° F. temperature and 28 (30 Engl.) atmosph. press., 3·17017 kilogr., and are contained in 5·253 kilogr. of pure and dry common salt. But when the amount of sulphuric acid, as calculated by the anhydrous muriatic acid, there is only one equivalent for the decomposition of the common salt, whereas, for the purpose of obtaining, in extracting the chlorine, a complete and easy decomposition, two equivalents are required, there is one equivalent more of the common salt to calculate, and to add to that which resulted by the calculation with the muriatic acid; for instance, to make 1000 litres of chlorine by means of the manganese No. I., there is required so much of the hydrated sulphuric acid (English sulphuric acid of 1·85 sp. gr., or 67° Baumé) as corresponds to 6·629 kilogr. anhydrous muriatic acid; that is, 8·938 kilogr., which suffice to saturate the oxides of the 4·025 kilogr. manganese, but is only half as much as is necessary to decompose the common salt: hence, to the 8·938 kilogr. there must be added 4·394 kilogr. for the common salt. On the whole, there will, therefore, be required 13·332 kilogr.

The following is a summary:—

Manganese.	Com. Salt, Pure and Dry.	Sulphuric Acid, 67° Baumé.
	Kil.	Kil.
I.	4·025	5·253	13·332
II.	4·665	5·253	14·497
III.	5·257	5·253	15·323
IV.	6·648	5·253	15·816

In conclusion, we need hardly mention that the manganese of Giessen may be considered equal to the best sorts of manganese occurring in commerce. —nt—.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

A LECTURE ON THE STATE OF PHARMACY IN ENGLAND, AND ITS IMPORTANCE TO THE PUBLIC; WITH REMARKS ON THE PHARMACEUTICAL SOCIETY.

(Delivered at No. 22, Conduit-street.)

BY J. LLOYD BULLOCK, PHARMACEUTICAL CHEMIST.

GENTLEMEN,—

In undertaking to conduct you through a course of Practical Pharmacy, I deem it to be almost indispensable that I should, previous to entering upon our labors, give you a sketch of the subject I am about to teach, the qualifications necessary to those who would pursue it, and the relation in which the Pharmacien in this country stands towards the public generally, and the practitioner of medicine more especially.

The practice of Pharmacy, that is, the preparation of those substances which are employed in the cure, or relief of diseases, has, as you well know, only in modern times been separated from the practice of the healing art. Of old, every physician prepared the remedies which he administered. The separation of Pharmacy from the practice of medicine must not be held to be a mere refinement founded upon increase of luxuriousness essentially useless in itself, but as an absolutely necessary relief to the practitioner of medicine, who, although, doubtless, he ought to understand the processes employed in the preparation of his medicines, cannot, to any good purpose, occupy himself with their manufacture. The reason which is sometimes assigned for this separation, and for the origin of the Pharmacien, namely, that it is undignified for the practitioner of medicine to engage in trade, if intended to convey a reproach upon us, on account of our necessary commercial relations, may well, in this country, be left to refute itself. It is not my intention to institute an inquiry on this point, or to attempt to determine the comparative degree of estimation in which professions or commerce should be held, whilst, at the same time, I claim for Pharmacy the title of A PROFESSION. I do so, because if we do not make the distinction between a profession and a trade to depend upon the former having a scientific basis, whilst the latter requires no previous acquaintance with science, I scarcely know how to mark the distinction. This question, however, in itself, is of little importance; but it is altogether another matter with respect to the opinion which may be entertained, as to the necessity of science for qualifying an individual to practise Pharmacy. Upon this point there ought to be no controversy, nor can there be any between persons who have, in the least degree, attended to the matter; because I conceive that the single consideration, that to the Pharmacien is entrusted the preparation of the substances which Physicians prescribed for the cure or alleviation of diseases, is quite sufficient to convince every reasonable man of the necessity for a knowledge of chemistry, in order to practise Pharmacy with safety to the public. That I should have occasion to dwell upon this point, or to offer any illustration of the absolute necessity for a knowledge of chemistry in a man who prepares medicines, indicates at once the strange state of things which exists in this country, and to which I must call your attention.

What are the substances which fill the bottles and drawers of the druggist's shop? Compounds, many of which have been discovered by chemists, and requiring in their preparation considerable skill in chemistry. There is no longer any distinction between Galenical and chemical remedies. Such vegetable substances as are employed by the physician are as much under the dominion of chemistry as the metals. Nay, the dependence of their properties, in relation to disease, upon subtle principles, which have been detected and separated by the chemist, shows us that a knowledge of chemistry is even still more necessary in dealing with them in the operations of Pharmacy than it is with mineral compounds.

In those bottles and drawers are contained the materials upon which the health, the lives, of men are made to depend. The physician examines his patient, he discovers the existence of an acute disease, arrived, perhaps, at that point in its progress where, if it be not at once arrested it is surely fatal—the moment for staying it, once lost, is irretrievable—the means of accomplishing its arrest are known to him, and he sits down to write the forms under which those means are to be administered. The prescription thus written is, perhaps, the warrant of reprieve to the patient, the document which is to prolong his existence.

Now, gentlemen, fancy this significant paper placed in the hands of a man ignorant of chemistry; see this man in total ignorance of the contents of the bottles he is collecting round him, and which he is commingling into the all-important potion; he knows not their constituents, he knows not their mutual actions and reactions on each other; a fraudulent dealer has sophisticated the contents of one of those bottles; the false ingredient renders the whole compound different to the intended remedy—it destroys its whole efficiency; and this worthless dose—exhibited to the patient at this critical moment, the golden opportunity of interposing an efficient remedy—is lost, and that life—who can say how valuable to friends, family or country—is sacrificed at the shrine of ignorance!

Take another less serious example. A patient has passed many restless nights, his body nearly worn out with incessant watching, his mind harassed, and his frame arrived at that common state of nervous excitement when sleep is impossible; the physician prescribes a sleeping dose—say it shall be one of those active and powerful principles derived from opium: the prescription reaches the hands of a Pharmacien ignorant of chemistry, he prepares the dose from his stock, but that white powder he is using has not been skilfully tested; it contains, indeed, the precise salt of morphia ordered to be given, but it is impure, or mixed, from the cupidity of some dealer through whose hands it has passed, with a cheap ingredient, or its impurity arises from some defect in its preparation, and its strength is, perhaps, not one-half that of the true substance intended to be given (the illustrative example I am giving you, gentlemen, is of frequent occurrence). What is the result? Instead of the soothing anoydne effect which is to restore the patient, through a refreshing sleep, to his wonted health and peace, the dose, being too small, adds greatly to the evil it was hoped to remedy; it increases the nervous excitement, wholly banishes sleep, and, very likely, throws the patient into an alarming delirium.

But you will perhaps say, all this only proves that the Pharmacien should take care to purchase his drugs and chemicals only from such dealers as can be relied on for knowledge and integrity. Doubtless, there are abundant wholesale druggists and chemical manufacturers, most honorable and upright men, incapable of practising deception and taking advantage of the ignorance of their customers. But there are not a few who deem such practices as diluting, with an innocuous substance, a costly drug, no crime, and therefore practise it without remorse. Besides, there are many causes which may bring into the dispenser's bottles a substance so weak as to be inefficient, or so different to the one intended to be kept there as to be more than worthless, positively mischievous, in cases wherein it is usually prescribed. Many substances are manufactured in large quantities, and these must be manufactured by workmen who do not understand the processes which they practise. A few years ago, a physician at one of the great metropolitan hospitals—a bold experimenter—among other things, began to examine the effects of the iodide of potassium upon the human body; he commenced by prescribing a few grains, but perceiving no result, he increased the dose; still, as he saw no effect, he added more and more to his prescription, until he reached, if I remember rightly, some drachms. At last it occurred to somebody to inquire whether the substance given in such large doses was pure or not, when it was found that it contained more than seventy-five per cent. of carbonate of potassa, and the wonder was easily explained.

If you would wish to pursue this subject further, and to judge how far the effects of remedies are likely to be modified by such substitutions, let me refer you to a series of papers published by Mr. Phillips in some late numbers of the *Pharmaceutical Journal*.

What, then, you may ask, is the way of escape from these evils? How is the public to be safe in entrusting the preparation of medicines to Pharmaciens? To these questions the answer is obvious—THE MAN WHO PREPARES A PRESCRIPTION OUGHT TO BE CAPABLE OF MAKING AN ANALYSIS—HE OUGHT TO BE A SCIENTIFIC CHEMIST. But what is the state of things in this country? I am really, gentlemen, almost ashamed to enter upon this part of my subject; it is only in the hope that I may be instrumental in effecting some small degree of good that I venture upon the offensive, and very likely it will prove to many—the offending, topic.

Why, the plain truth is, the majority of chemists and druggists in this country are totally ignorant of chemistry, in spite of their name, which has been assumed, I suppose, upon the principle of *lucus à non lucendo*. They undergo no examination—they are under no restriction. A grocer may displace his canisters any day he pleases, an oilman his casks, and supply their places with substances, single grains of which may consign to their graves their equally ignorant neighbors. The boy who has carried out the medicine of the general practitioner,

learns to spell the names on the bottles in the dispensary, and he is forthwith qualified to be a Pharmacien; he takes a shop, writes up "Chemist," and the confiding public enjoys the precious boon.

I shall not enter upon the delicate question of whether or no the legislature ought to protect the lives of the people, by enacting that the Pharmacien shall be qualified by a knowledge of chemistry, shall undergo an examination before a competent authority, and receive a sanction, in the shape of a license, to practise Pharmacy? In this country any restraint upon the liberty of the subject is looked upon with jealousy—even the liberty to poison is esteemed too sacred to be abridged; we must, therefore, leave this matter in the hands of our rulers, indulging, however, a wish that a sense of his own personal danger may arouse some influential senator to agitate the question, and determine it, after a full and deliberate examination.

And now, gentlemen, I must advert to the Pharmaceutical Society—a society established with the professed intention of accomplishing for the chemists and druggists of this country, and the practice of Pharmacy, what the legislature had failed to do. At its first institution, under the impression that these intentions, if fairly carried out, would be beneficial, I joined it as a member. That I have thought fit to withdraw is a plain declaration of my disapproval of its subsequent proceedings; and I will now explain to you upon what I found my disapprobation of the Pharmaceutical Society. In the first place, this society, if established for the benefit of Pharmacy, should have kept to a strictly honorable course. Whether it has done this, I will leave to your own judgment when I tell you, that instead of the just and reasonable motives which might have been urged upon chemists and druggists to unite in such an association, an expectation has been studiously held out that members of this society only would be held legally qualified to pursue Pharmacy, whilst persons who should not become members would lose this important privilege. Every insinuation of this kind, every exaggerated statement of the value of a charter, the council well knew was calculated to convey a false impression. Secondly, the fixing of a time to allow persons to enter the society with no other qualification than the payment of its exorbitant annual demand; whilst, after that period, it would only admit persons upon an examination by a self-constituted court of examiners—and therefore inefficient—and a large fee. These, coupled with the fears excited of the consequence of neglect, induced timid persons to join it in great numbers, fit and unfit, whilst it deterred many persons, the most respectable and best qualified to advance Pharmacy, from joining it, and thus introduced an element of future dissolution. Thirdly, the distribution of a diploma, which was designed especially to permit the less scrupulous persons, who were willing to pay for it to impose upon the public, with a document which could not readily be distinguished from a legal license to practise. If you think this remark somewhat strong, permit me to quote the passage in the *Pharmaceutical Journal*, wherein this scheme was first suggested. It occurs in an imaginary conversation held between the editor and a country druggist:—"You ought to send to each member an engraved certificate of membership, signed by the President and several members of council, which certificate may be framed; otherwise how can the public distinguish between members and unqualified persons?" The hint thus thrown out has not been lost, and you will see this paltry print paraded before the public eye, evidently to carry out this intention. Again, I think it may be safely said that no other society, framed with a view, either real or pretended, to advance a science or an art, ever thought of examination as a condition of membership, or of paying away to one of its own members a large proportion of its income for publishing its own papers.

Lastly; you must observe, that by obliging every member and associate thus to pay for the *Pharmaceutical Journal*, instead of permitting its transactions to be published, as they may be worthy of publication, in the proper channels, the society wholly overlooks the interest of its members, because where a member has induced his assistants to become associates, it happens that five or six, or more, numbers of the journal are sent to a single establishment. If the cost of these were expended upon other journals, a chemist and druggist might supply his assistants and apprentices with most valuable information from a variety of sources, besides promoting a fair competition in the literature of our profession.

These things are painful to speak of, and I should not, gentlemen, condescend to notice them, did I not feel that instead of advancing the profession of Pharmacy, this society, by its very exceptionable practices, has rendered it the more difficult to effect any good, and will serve but to obstruct all attempts at future reform and improvement.

That reform must consist mainly in every Pharmacien being compelled to become a profound practical chemist; for whatever

other acquirement may be thought desirable—and I could furnish you with a list of all the branches of human knowledge, and trace some connection of our profession with every one of them—chemistry is indispensable. I would by no means discourage you, gentlemen, from acquiring a competent acquaintance with ancient and modern languages; of Latin you must know somewhat, it is imperative upon you to do so; but with French and German I would recommend you most earnestly to acquire an acquaintance. In those languages you will find, not only our own profession and art, but the science of chemistry, in a far higher condition, and in a more vigorous state of progress than in our own; you will infallibly be able to derive information from them of the utmost importance to your own personal success. Learn, too, as much as you can of botany, mineralogy, and natural philosophy, and then, as time or opportunity serves, add to these any branch of science or any accomplishment, your tastes may render attractive; every part of science, every kind of knowledge, has its own attractions, and may be pursued as a relaxation, but chemistry is our corner-stone. It is more to the Pharmacien than anatomy is to the Physician or Surgeon—it is the root and substance of all our art in its development and perfection. Become Chemists, and you will no longer rest satisfied to perform that which it is your duty, and for which you will be well qualified, namely, to prepare the remedies prescribed, but you will be able to present the Physician with his remedies in new and improved forms, you will be able to furnish the particular combination of elements which is best adapted to enable him to carry out his designs.

Nothing can serve to display the unsatisfactory state of the practice of Pharmacy in this country more than the reflection that of all the vegetable alkaloids—those subtle principles which present to us the properties of medicinal plants, and now in constant use throughout the world—not one was discovered in this country. We are indebted to the French and German chemists and Pharmacien for this improvement, the benefit of which is really incalculable. Not only can the physician administer the most valuable vegetable remedies, separated from the large amount of woody fibre and other inert matters with which their active principles are found in Nature, but he can now be certain, which he could never be of old, that the remedy he prescribes is in a state of efficiency. The salts formed by combining the vegetable alkaloids with acids, are safe, sure, and definite in strength, and when properly prepared, preserved pure, and given as prescribed, may be depended upon, and what is of vast importance to science, will furnish positive or negative results to experimental inquiries. Such could not be the case with the whole substance of any vegetable production. Time, damp, accidental enclosure of insects in the same bottle or drawer, rendered inert the choicest specimens, and falsified the inferences drawn from their effects on the economy, misled the physician, and perhaps destroyed the patient. And pray, gentlemen, do not allow the suspicion to cross your mind that no further improvement, no other discovery, is needed; this would be insurpassable weakness and folly; there is not one single agent in use as a remedy, there is not a plant, a mineral, a metal, about which there is not much still undetermined; and as chemists and physiologists are rapidly together advancing the knowledge of the human body, the nature of its elements, and the laws of their combination, so must the demand arise for improved forms of remedies, new substances which may meet the requirements of advanced science, and the most refined adjustments of those already known to the exigencies of disease, and disturbances of natural functions.

Let me select, as an illustration, a metal which has been in use as a remedy from the earliest ages to the present moment, not at intervals, but constantly and without any interruption, namely iron. Until recently, no preparation of this metal existed which was not disagreeable to the taste or nauseating to the stomach; but lately it has been found that certain combinations of iron with vegetable acids, and especially the citric acid, obviates both these objections, and thus a valuable amelioration has been effected in practice. But it is to enforce upon you the necessity of chemistry, and to express, moreover, another sentiment, namely, my sense of the great propriety that the Physician and Pharmacien should co-operate in a department where their respective functions meet and find a common ground, that I select the following out of innumerable instances which might be taken.

If you look into the Pharmacopœia of the London College, you will find, under the head of sesquioxide of iron, and after the directions for its preparation by precipitation and washing, that it is to be dried. Now, you will observe that the temperature at which the drying process is to be conducted is not mentioned, and it seems to have escaped the notice of the framers of the Pharmacopœia, and, I may add, of most compilers of works on Materia Medica, that

this is a matter of some importance. This preparation was formerly called carbonate of iron, because the immediate result of the reactions upon adding the carbonate of soda to the sulphate of iron is the formation of a carbonate of iron. But it was found that the oxygen of the atmosphere displaced the carbonic acid and converted the product into peroxide of sesquioxide of iron. Now, it has not been distinctly ascertained whether the medical efficacy of this preparation may depend upon a still-adhering minute proportion of carbonate of protoxide, or upon a hydrate of the peroxide of iron. If dried at a high temperature, the water is expelled, and the peroxide rendered anhydrous. We know that in this state it resists the action of weak acids, to which it readily yields in a hydrated state; and we can explain an observation of an old practical physician made in the last century, that the drying of this preparation at different temperatures produced a most important difference in its therapeutic effects. You are probably aware, that this form of iron is used in a most painful class of diseases, called neuralgia, of which tic douloureux is the best known example. A recent writer upon this class of morbid affections, in estimating the value of iron in neuralgia, mentions the very variable effects of the sesquioxide, and says that many cases have occurred where such enormous quantities have been taken, as to endanger the life of the patient by accumulating into masses in the bowels. The unhappy sufferer from nervous pain swallows these prodigious quantities of matter which, in all probability, owes its property of affording relief, either to a minute quantity of accidentally-adhering carbonate of iron, or to a state of the peroxide in which it may be found in one specimen, and not in another, so that relief or failure will depend upon a mere accident, the ground of which is known neither to the prescriber nor the preparer of the medicines.

Another example of the necessity of co-operation between the Physician and the Pharmacien may be drawn from the salts of quinine at present in use as remedies. Many salts of quinine are known to chemists, which, reasoning from analogy, must be supposed to afford far better, and more efficient means of exhibiting this powerful remedy than those in constant and daily use; the only one very extensively employed is commonly known as the sulphate; it is, chemically speaking, a di-sulphate, a salt in which the base predominates, and, in its pure state, is insoluble in water. In order to render it soluble, the prescriber is in the habit of adding sulphuric acid; but as there is no rule for this, and as it is a delicate matter to render the quinine exactly neutral, there is usually a superabundance of acid added, and thus an amount of free sulphuric acid is taken into the stomach, where it may, in many cases, be by no means desirable that it should be administered. Now, this uncertainty might be avoided by preparing the sulphate—well-known to chemists—a salt perfectly neutral, soluble, and presenting the quinine in a form far more suitable than the di-sulphate. There are, however, other soluble and neutral salts of quinine which might be employed, and it is a problem worthy of an experimental inquiry, how far the different acids, in combination, influence the action of bases on the animal economy.

A third instance, to illustrate the point before us, may be derived from the present state of our knowledge of vegetable extracts. Many methods are in use for their preparation, but they seem to be applied indiscriminately, without any attempt to determine the special adaptation of any particular method to any given substance; or, again, to determine the exact therapeutic value of extracts, prepared in these different ways. This form of administering vegetable remedies has always been deemed to possess great advantages; extracts seem to give us the virtue of plants most nearly in the form in which Nature presents them to us, and it is, therefore, an investigation well deserving of being pursued to determine these questions.

Well, then, gentlemen, in conclusion, let me again impress upon you the indispensable necessity of chemistry for the practice of Pharmacy. Let me advise you to lay aside every other pursuit, and attach yourselves exclusively to this science, until you have attained sufficient skill to perform a satisfactory analysis of inorganic and organic compounds. Not only will it enable you to take a position in society of which you cannot be ashamed; not only will it enable you to perform the usual and daily offices of your profession—to prepare the remedies of the physician—to manufacture the several ingredients as he usually prescribes them—to avoid the use of a spurious, adulterated, or deteriorated drug—any wrong chemical substance; but chemistry will enable you to realise the ambition, which every man ought to entertain, of advancing the science to which he is devoted; to discover new or improved forms of remedies; new, cheaper, and better processes for preparing old ones; and thus you will, at the same time, and by the most honorable means, ensure your success in business, and aid the benevolent and

exalted labors of the physician in lessening the amount of human suffering. But there is a further use in thus becoming a good practical chemist; it will enable you to be the counsellor of the agriculturist, of the manufacturer, of the physician—to spread the love and practice of chemistry, and thus to lend your assistance towards advancing the most important science which can engage the human faculties.

THE GREAT ANNUAL MEETING OF THE PHARMACEUTICAL SOCIETY.

On the 21st of May took place the above important meeting, which was announced for eleven, a.m., *precisely*, but which did not actually commence until half-past twelve, the council being unable until then to whip together enough members to move the usual resolutions. In fact, there were present only twenty of the council cleet, the five auditors elect, the six members who were put up as puppets to propose the resolutions, the secretary, the curator, and the reporter to The Chemist, making in all 34 persons present on this interesting occasion, out of the sixteen hundred members of the Society. The chair was taken by Mr. Savory, who was not prepared to make a speech on the present occasion, but would call on the sceretary to read the report, which consisted of the ordinary verbiage used for such purposes.

Mr. Tosswill rose to propose the first resolution, that the report be adopted, re-echoing the words of the report, in the true style of Pharmaceutical eloquence.

Mr. Macfarlane briefly seconded the motion, which was carried unanimously, as the chairman said, all the council holding up both their hands to assist the other fourteen members in making "a show."

Mr. Yarde moved, without one comment, that 500*l.* be added to the benevolent fund.

Mr. Pedler seconded the above, quite exhausted by the effort, which was carried *nem. con.*

Mr. Swire then proposed a vote of thanks to the council in a most mechanical and consequently uncomplimentary manner, merely repeating the words of the resolution, which was seconded by a gentleman who did not add one word of comfort. The motion, of course, was carried without a dissentient voice.

Mr. Lescher begged to observe, that he considered the *members* had shown a gross want of *gratitude* to the council in not *attending* at the present meeting!!!

Several of the council, evidently considering that Mr. Lescher had *betrayed* them by the above speech, here declared, that they believed the non-attendance of the members arose from the great confidence they had in the council!!!

Mr. Herring felt the great good the Society had conferred on the members by "hedicating" them. He found, before the establishment of the Pharmaceutical Society, to sell good drugs was like "throwing pearls before swine" (hear, hear); but he now found they knew what good drugs were.

Mr. Hallowe was sincerely obliged to the council for having *elected* him one of their body; he experienced the great benefit the Society had conferred on his apprentice, in a letter he had received from Dr. Thompson, who stated therein, that his apprentice very *nearly got* the prize for Botany, and would have done so had there not been *other pupils* who knew more of the subject.

We must not omit to mention, that *the applause* was admirably *led* by Mr. Squire, and well accompanied by Mr. Waugh upon a large stick, the whole council performing their respective parts with great taste and judgment. We were unable to ascertain the cause of the absence of the five ex-members of the council who had so meekly resigned their appointment in deference to the wishes of their brethren.

The foregoing Report shows that the members of the Society are becoming sick of the absurd exhibitions which they assist in maintaining. If they are silly enough to contribute their money towards such nonsense, they are not bound to go and behold the effects of their folly.

It is our intention next month to make some comments on the Pharmaceutical Society and its management, and to expose some circumstances which the council would willingly conceal.

We have many facts to bring forward which will prove the degree of estimation in which the Society is held; and we shall also give our readers full proof that it has decreased in numbers, thus giving ample evidence that our statements concerning the secession of members were well founded.

Our readers will perceive that we have not been quiet all this time without powerful motives.

ON THE PREPARATION OF PHARMACEUTICAL EXTRACTS.*

BY M. BURIN.

In a volume, which I hope shortly to publish, I have given a series of articles on the preparation of extracts, which, considered altogether, constitute a special method, resting on the following principles, which I propose to develop according to the importance which they merit, or which I attribute to them.

1. A vegetable substance being given, to endeavor by all possible facts to ascertain what are the matters which chemical analysis indicates as constituting it, and those to which the medical action which the substance itself possesses must be attributed.

2. The active parts being known, to study their chemical characters, in order to discover, among other things, the solvent fit to be employed for removing these parts, by disengaging them as much as possible from those which are inert, and which, consequently, cannot injure the preservation of the product, and neutralise the energy of its properties.

3. To proceed to the evaporation of the liquid which serves as a vehicle, by avoiding in a manner which ought to be complete the decomposing action which organic bodies, whose nature is always so unstable, undergo with such facility, in contact with such chemical agents as heat, air, and water.

Relying on these principles, I think it my duty here to give the explanation of the *modus operandi* which I have adopted for preparing some of the most commonly employed extracts.

BELLADONNA, STRAMONIUM, AND HYOSCIAMUS.

Most of the *Solanaceæ*, and especially those which I have just named, contain active principles, whose chemical characters and action on the animal economy present the greatest identity with each other.

For preparing the extracts of belladonna, stramonium, hyosciamus, and other *Solanaceæ*, I take:—

Leaves and stalks at the commencement of flowering, alcohol at 36° .. .	Of each equal parts.

The plant, carefully bruised in a marble mortar, is pressed with the hands, then again submitted to the action of the pestle. The juice obtained is afterwards again united with the plant; alcohol is added, and it is allowed to macerate for six days. The whole is then put into a sieve, and the dreg submitted to the action of a powerful press. The combined and filtered liquors are afterwards distilled, *in vacuò*, if possible, or, in the contrary case, in a sand-bath, in order to extract all the alcohol (in the distillation in the sand-bath, the evaporation being performed out of the action of the air, the product undergoes no alteration). The residue is allowed to cool, and the liquor is afterwards filtered in order to separate the chlorophylle which is precipitated. The evaporation *in vacuo* is then proceeded with, or, if the necessary apparatus be not at command, the product is divided into layers of about two centimètres in thickness, in large moulds of white iron rubbed with mercury, and it is left to spontaneous evaporation in a stove with a continued current of air, heated to from 95° to 104°F. When the extract has arrived at the consistence of honey, it is again dissolved in three times its weight of alcohol. It is again filtered, distilled in a sand-bath to extract two-thirds of the alcohol, and the evaporation is finished in the stove.

The product should be preserved in well-corked bottles.

The *modus operandi* which I adopt in dissolving the hydroalcoholic extract in concentrated alcohol, has for its object the separation of a certain quantity of salts soluble in weak alcohol, as well as inert coloring extractive matter,—but it is right here to mention that this process is not new; indeed, it has already been applied by M. Dublanc to the extract of lettuce juice; by M. Lembard to extract of aconite; and, finally, MM. Georges and Hespe have recommended its application to the aqueous extracts of hyosciamus and other *Solanaceæ* obtained with the dried plant.

The extract of these three plants have a *purpurine* yellow color when they are spread in a thin layer; they present the green odor of the plant; their taste is bitter at first, then the mouth becomes dry and pasty, with a sensation of astriction at the back of the throat, which is accompanied by an effect on the brain exactly similar to that caused by a small quantity of tobacco smoke in a person who is not habituated to it.

They very powerfully dilate the pupil.

One part of extract represents the principle soluble in water and alcohol.

	PARTS.		PARTS OF POWDER.
Of fresh Belladonna ..	88	or	12
Stramonium	100	or	12
Hyosciamus	105	or	16

It is composed of yellow extractive, a complex body which retains a certain quantity of odorous oily liquid, and of all the crystalline alkaline matter, or of the poison-

* *Journal de Pharmacie*, May, 1844.

ous or medicinal principle of the plant which is found in it in a state of preservation, which should be regarded as perfectly normal, all chances of alteration which might have arisen from the mode of operating, or from the mode of evaporating, having been almost entirely avoided.

These extracts can be sold only by the special direction of physicians, and the chemist should not employ them instead of the same extracts prepared by the ordinary methods.

EXTRACT OF GENTIAN.

The observations of MM. Planche, Henry and Caventou, and of M. Le Conte, have made known in gentian the following substances :—

Fugitive odorous principle, gentisin, glue, greenish oily matter, uncrystallisable sugar, gum, pectic acid, fawn-colored coloring matter, organic acid, and bitter extractive matter.

MM. Henry and Caventou extracted from gentian a crystalline matter, to which they gave the name of *gentianin*, and which they regarded as the bitter principle of gentian, but this substance, or gentisin, as MM. Le Conte and Trommsdorf have demonstrated, is only a pale yellow coloring matter, crystallisable in long needles, insipid, and inodorous, which is mixed in gentianin with variable proportions of bitter principle and fatty matter. (E. Soubeiran, *Traité de Pharmacie.)*

From these facts it results that the chemical nature of the bitter matter of gentian remains to be determined; and, as will be seen, as now obtained, it is presented under the form of an uncrystallisable extractive matter, very soluble in alcohol.

Gentian, in coarse powder } *aa* q.s.
Alcohol, at 36° ..... }

The gentian is exhausted by Cadet's process, by three successive treatments with twice its weight of alcohol at 36°. The liquors are combined and distilled in the sand-bath, in order to remove all the alcohol. The extract obtained is dissolved in distilled water, which removes the bitter matter, sugar, and free acid, and leaves the fatty matter combined with the gentisin. It is filtered—the evaporation is completed on a stove, and when the product is brought to the consistence of a thick syrup, it is spread in thin layers, on white iron plates rubbed with mercury—then gently wiped with a cloth imbibed with a very small quantity of oil of almonds. When the extract is dry, it is sufficient to strike the back of the sheet of white iron to detach it in beautiful yellow and transparent plates, which mus be kept in carefully-corked bottles.

This extract, as is evident, contains only the aromatic bitter matter of gentian, sugar, free acid, and probably also a certain quantity of gentisin, retained by the bitter principle. It represents the active principles of this substance in a state of great concentration, and is capable of forming the basis of excellent preparations.

One part of the extract is exactly equivalent to ten parts of gentian root.

EXTRACT OF DIGITALIS.

Like gentian, three successive digestions in alcohol, at 36°, perfectly exhaust digitalis of all its bitter and coloring principles. The liquors are combined—two, three, or more quarts of distilled water are added, according to the quantity of matter treated. (The addition of this water has for its object to dissolve chlorophylle, which doubtless carries along with it a considerable quantity of the active principles.) Then it is distilled in a sand-bath, to extract all the alcohol; it is allowed to cool and filter, in order to separate the chlorophylle. By afterwards operating as in the case of gentian, a dry extract is obtained under the form of beautiful, transparent, and very slightly-colored plates, possessed in a high degree of the bitter taste and peculiar odor of digitalis: the odor becomes especially perceptible when the extract is bruised or moistened with a little water. There is no doubt that this extract is very energetic, and preferable to every other; and that, in the hands of a skilful practitioner, it may form the basis of preparations of certain medicinal action.

One kilogramme of powdered digitalis yielded me 108 grammes of dry extract. But, taking into consideration the losses which are unavoidable in operating on more considerable quantities, it may be admitted that one part of dry extract is equivalent to ten parts of dry plant.

This extract should not, therefore, be substituted for the ordinary extracts of digitalis without a special indication.

EXTRACT OF VALERIAN.

An analysis, due to Trommsdorf, made known in the root of valerian the following constituents :—

Volatile oil	Soluble in Alcohol
Resin	
Peculiar volatile acid (valerianic acid).....	
Aqueous extract	Soluble in Water.
Peculiar matter	
Starch	

Experiment has demonstrated that the volatile oil, valerianic acid and resin are especially the active principles of valerian. On the other hand, the extractive matter is not without action; therefore, there must be introduced into the product the greatest possible quantity of the first three substances, and a certain proportion of those which are soluble in water must also be admitted.

The following is the *modus operandi* which I recommend:—

Valerian in coarse powder q. s. carefully moistened with twice its weight of alcohol at 38°. After three days' contact, introduce the mixture into an ordinary lixiviation apparatus, and displace by an equal quantity of alcohol at 22°. By distilling the first product you will have as a residue a mixture almost entirely composed of a resin of a deep green, holding in solution the whole of the volatile oil and valerianic acid. This product is then put into a well-corked vessel, or the alcohol obtained from the distillation is diluted with pure water, to bring it to 22°, in case of a deficiency of fresh alcohol of the same density in sufficient quantity to exhaust the valerian. All the liquors are combined and filtered, and the spirit is removed by distillation; the residue is evaporated in a stove to a pilular consistence, then the first product is incorporated by aid of heat, which perfectly dissolves it; it is thus obtained in a perfectly homogeneous state, which represents in a perfect state all the active parts of the root of valerian.

One part of extract is equivalent to 5 per cent. of this substance. The object proposed in the preparation of extracts is to concentrate into a small mass the active parts of plants, without changing the state of combination in which they may be naturally engaged. M. Burin proposed to generalise further the employment of concentrated alcohol, already recommended before him, in order to concentrate the active part, and eliminate the inactive part. This object appeared to me to be attained as regards the *Solanaceæ*. Is it also attained as regards the other plants selected by M. Burin? I will here only offer two observations, one relating to valerian, and the other to gentian; I operated on the same root in each trial, in order to have comparative results.

EXTRACT OF VALERIAN.

One kilogramme of substance.	Extract obtained.	Relation to the substance.	Action of Water dissolves:	Action of Alcohol at 21° dissolves:	Action of Alcohol at 36° dissolves:
Burin's process	255 grms.	: 1 :: 4	80 per cent.	88 per cent.	96 per cent.
Process of the Codex	205 ,,	: 1 :: 4·83	88 ,,	94 ,,	80 ,,

These two extracts were both very aromatic; that of the Codex was, however, rather less, and its color was darker. I diluted them with water, and obtained the following results:—

Burin's extract dilution at.....	$\frac{800}{1}$	The specific odor annihilated.	
,,	$\frac{1000}{1}$	,,	taste annihilated.
,,	$\frac{2000}{1}$	,,	bitterness annihilated.
Extract of the Codex dilution at..	$\frac{400}{1}$	,,	odor annihilated.
,,	$\frac{800}{1}$	,,	taste annihilated.
,,	$\frac{1000}{1}$	,,	bitterness annihilated.

The substitution of alcohol at 36° for alcohol at 21° did not, therefore, present any very great advantages.

EXTRACT OF GENTIAN.

One kilogramme of substance.	Extract obtained.	Relation to the substance.	Dissolves in all proportions excepting flocks:	Dissolves all proportions:	Alcohol dissolves:
Burin's process	112 grs.	: 1 :: 8·9			96 per cent.
Process of the Codex	364 ,,	: 1 :: 2·75	98 per cent.	85 per cent.	20 ,,

Burin's extract dilution at	$\frac{10\cdot000}{1}$	Bitterness still very sensible.
,,	$\frac{20\cdot000}{1}$	Bitterness distinct, but at its limit.
,,	$\frac{40\cdot000}{1}$	The color is perceptible; bitterness distinct.
,,	$\frac{20\cdot000}{1}$	Bitterness annihilated.

The extract made with alcohol at 36° contains, therefore, the bitter principle in a state of great concentration. But at what price is this advantage bought? Three times less product is obtained; because alcohol at 36° is not a very proper vehicle for depriving gentian root of its bitter portion. When it ceases to act, alcohol at 21° may be charged with a very considerable quantity of its active parts; it is doubtless preferable for the preparation by extraction.

These two examples are sufficient for showing all the inconveniences which might exist in separating an absolute principle and in generalising its application. When it is required to extract the soluble matters contained in plants, it should not be forgotten that the solubility proper to each of their isolated principles is not the same when different principles are associated with one another, and that we should not judge, *à priori*, of the action of vehicles of solution on each of them.

TREATMENT OF LEAD COLIC.*

BY DR. HOFFMANN, OF NEU-RUPPIN.

Dr. Hoffmann avers that too much praise cannot be given to the employment of alum associated with opium in the treatment of lead colic. According to him, when the inflammatory symptoms are combated by the appropriate means, the administration of this medicine powerfully serves to diminish spasms, to regulate the alvine evacuations, and greatly to calm the health.

CEMENT FOR THE TEETH.‡

BY OSTERMAIER.

According to Ostermaier, this cement is prepared by mixing 52 parts of chemically pure and finely-powdered caustic lime with 48 parts of pure anhydrous phosphoric acid, obtained by the combustion of phosphorus in dry air; the mixture is rapidly triturated in a mortar.

A sufficient quantity of the powder thus prepared is then introduced into the cavity of the carious tooth; it is strongly compressed, and the surplus is equalised as much as possible, then it is slightly moistened.

It must be observed that this powder can be used only in one or two minutes; consequently, it should be prepared only just before it is used.

* *Medicinische Zeitung.*

† *Jahrbuch für Praktische Pharmacie.*

EFFICACY OF CREOSOTE IN CASES OF OLD ULCERATIONS OF THE FEET. *

BY DR. VÖLPERLING, OF WOSTERHAUSEN.

In a subject very liable to erysipelous and rheumatism, and who was afflicted with a putrid ulcer of the foot, ointments, plasters, cataplasms, and fomentations, not being supportable, Dr. Völperling prescribed the application of a paste prepared with *poplar* charcoal, and water containing creosote.

The success of this treatment was such that the ulcer became clean, and exhibited all the characters of an ulceration of a favorable nature. It was easy to prove that this result was due to this treatment alone; for, on returning to the use of ointments and plasters, the ulcer resumed its former fagedenic aspect. Finally, by means of a sustained application of the creosotic paste, a perfect cure was effected.

ON THE MEANS OF PREVENTING OR CURING THE INJURIES CAUSED BY A LONG DECUBITUS.†

BY DR. TOTT, OF RIBNITZ.

Besides the means already known and used for preventing ulcerations by decubitus, Dr. Tott makes use of the following mixture, the formula of which is due to the celebrated Mursinna:—

℞—Tincture of camphor.. } 250 parts.
Goulard's vegeto-mineral water..... }

Mix.

With this mixture the points of the skin which have been rendered red by continued pressure, are washed, and these washings are

* *Medicinische Zeitung.*

† *Watter und Ammon's Journal.*

repeated several times during the 24 hours, taking care to shake the bottle well before pouring out the quantity of liquid necessary for each application.

If, notwithstanding the employment of this mixture, the symptoms remain, and the skin begins to ulcerate, Dr. Tott rubs the wounds with an ointment of lead and zinc, or, again, with the camphorated white rhazes: in the most serious cases he had recourse to tannate of lead, under the following form:—

℞—Recent tannate of lead.... 12 parts.
Lard..... 30 ,,

Make a perfectly homogenous ointment.

He applies this mixture three or four times a day.

But the best means which the author prescribes, as well by way of prophylatic for phlogosed surfaces, as for cicatrising those which are already ulcerated, is the creosotic water prepared according to the proportions indicated by Reichenbach (one part of creosote to 80 parts of distilled water). He employs this water in all cases, except in those where the wound presents a blackish cindery tint, that is to say, where gangrene already exists. In the latter cases, he recommends fomentations with the decoction of yellow quinquina, to which a small quantity of tincture of myrrh has been added, and he sprinkles the wound with a powder composed of camphor and myrrh, or he also applies to the ulcerated surfaces fine cloths covered with a layer of camphorated storax ointment.

PRESERVATION OF PATHOLOGICAL SPECIMENS.*

M. Pigne announces that a solution of creosote, in the proportion of 4, 5, 6, 8, or 10 drops, according to circumstances, to the litre, or pint and three quarters of water, forms an excellent, and of course very cheap liquor for the preservation of specimens. An entire subject, or any portion of it, kept in the solution of 10 drops, preserves all its physical characters and properties unchanged for an indefinite length of time. Pathological specimens, that have been shrunk and blanched by twenty years' keeping in spirits, are very speedily restored to their original form, size, color, and pliability, by being transferred to the creosote liquor. Portions of blood, pus, urine, &c., may be kept in it, without undergoing any change, and examined at leisure.

NEW FORMULA FOR AN AGGLUTINATIVE PLASTER.*

BY M. PRESTAT.

℞—Gummed diachylon plaster 400 parts
White pitch..... 50 ,,
Fine Venice turpentine .. 38 ,,

Melt the whole at a gentle heat; after liquefaction, add the two following substances, previously reduced to a very fine powder:—

Gum ammoniac ..... } 12 parts
Mastic resin..... }

Mix intimately, then spread in the usual manner on strips of linen.

During cold weather, it is convenient to increase the proportion of turpentine by ten parts, and to add to the mass—

Oil of sweet almonds.... 12 parts

This plaster, which M. Prestat has employed for ten years, joins to the advantage of being powerfully adhesive, that of never causing irritation of the skin.

IV. REVIEWS AND NOTICES OF BOOKS.

A BRIEF DESCRIPTION OF THE CHARACTERS OF MINERALS: FORMING A FAMILIAR INTRODUCTION TO THE SCIENCE OF MINERALOGY. By Edward J. Chapman. London: H. Baillière, 219, Regent-street.

A very useful work for beginners, by a gentleman already favorably known as the author of a work entitled "Practical Mineralogy," reviewed in a former number of this journal.

We give an extract from the preface, as showing the plan adopted by the author:—

"The following pages are intended as an introduction to my 'Treatise on Mineralogy,' lately published by Mr. Baillière, of Regent-street, or as an easy introduction to the science in general. They have not been written for the perusal of the advanced mineralogist, as their contents must be of course already familiar to him, but are offered to the unassisted student, as a simple and easy means of gaining a sufficient knowledge of the details of the science, as to enable him (with the assistance of the above-named work) to distinguish any mineral substance that he may chance to meet with.

"An elementary description of the principles of any science must necessarily be in part derived from the combined labors of preceding writers; the present brief essay

* *Gazette Médicale*, March 9, 1844, and *Medical Gazette*, April 12, 1844.

* *Encyclographie Médicale.*

will be found, however, to contain no inconsiderable portion of original matter and observation, and I am not aware of any other volume comprising so complete a union and exposition of the two principal divisions of mineral characters."

In conclusion, we recommend this work to those about to commence the study of this science.

TO CORRESPONDENTS.

PHILOMEL.—Probably it is the uncrystallisable sugar.

M. P. S., G. B.—We will consider the subject of your letter.

A LONDON CHEMIST.—Apply at our Office.

*** Complete Sets of THE CHEMIST can now be obtained.

[We have to acknowledge the receipt of Dr. Hare's communication, which will appear in our next.]

ERRATA IN DR. ROSENTHAL'S LECTURE ON THE TESTS FOR ARSENIC, No. LIII.

Page 227, line 42, for "arsenic," *read* "arsenite."

Page 228, line 22, for "cure," *read* "cur-"

Page 228, line 31, for "no substance," *read* "no other substance."

Page 228, line 51, for "steel crust," *read* "steel gray crust."

Page 229, line 49, for "almost always," *read* "sometimes."

Page 229, line 57, for "neither," *read* "either."

Page 229, line 58, for "nor," *read* "or."

Page 230, line 2, for "Herepath's," *read* "Herapath's."

Page 230, line 27, for "has," *read* "gas."

Page 230, line 30, for "supernatent," *read* "supernatant."

Page 230, line 40, for "ammonia, sulphate," *read* "ammonio-sulphate."

Page 230, line 41, for "ammonia, nitrate," *read* "ammonio-nitrate."

Page 230, line 59, for "of," *read* "with."

Page 231, line 7, for "boil," *read* "boiled it."

Page 231, line 14, for "outwards," *read* "upwards."

Page 231, line 22, for "a pound," *read* "a pound or two."

Page 231, line 24, for "Herepath," *read* "Herapath."

SUMMARY OF METEOROLOGICAL OBSERVATIONS MADE AT OTLEY, YORKSHIRE, IN APRIL, 1844.

BY E. THOMPSON.

BAROMETER.

Monthly mean	29·89
Mean at 9 a.m.	29·89
,, at 3 p.m.	29·89
,, at 9 p.m.	29·91
Maximum on 9th	30·30
Minimum on 4th	29·43
Range	·87

THERMOMETER.

Monthly mean	47°
Mean of maxima	55
,, minima	39
Maximum on 10th	63
Minimum on 29th	32
Range	31

WIND.

Days.		Days.	
N.	0	S.	0
N. E.	0	S. W.	6
E.	0	W.	15
S. E.	3	N. W.	2

RAIN.

0·30 inches.

WEATHER.

	Days.		Days.
Clear	15	Snow	0
Cloudy	7	Frost	1
Overcast	1	Hoar frost	2
Showers	5	Mist	4
Rain	0	Hail	0

GENERAL REMARKS.

A month remarkable for fine weather. According to a newspaper paragraph, "Never in the memory of the venerable personage, 'the oldest man living,' has such an April been known in this country."

The crops are said to be looking well, and the farmers are very busily employed in setting potatoes.

NOTA BENE.—*All Communications, Books for Review, and Substances to be Analysed, must be addressed "To the Editors of the Chemist, 310, Strand, London." Communications must be prepaid, and sent before the 15th of each month; Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

LETTER FROM R. HARE, M.D., PROFESSOR OF CHEMISTRY IN THE UNIVERSITY OF PONNA, TO THE EDITORS OF "THE CHEMIST," WITH SOME STRICTURES ON THE COMMUNICATION OF MR. REUBEN PHILLIPS.

MESSRS. EDITORS,

I HAVE read in THE CHEMIST for March last a communication from Mr. Reuben Phillips. The object of that communication is to show that the electrolytic experiments of Daniell are such as to justify the inference that the amphide salts consist of a compound radical in union with a metal, notwithstanding my effort to prove the contrary.

Mr. Phillips uses the following language: "During the electrolysis of water, and such like simple combinations, it may be conceived that oxygen is liberated on the anode, while the hydrogen passes on to the cathode; or hydrogen may be first produced on the cathode, and the oxygen may pass on from molecule to molecule, to the anode; or both effects may be simultaneously produced."

In the first place, I deny that any one of Mr. Phillips's cases can occur; I deny that either hydrogen, or oxygen, or both, can correctly be said to pass from one electrode to the other. At all events, there is no necessity for this species of locomotion. The phenomena may be sufficiently accounted for, if we suppose that from one extremity of a row of atoms of water existing between the electrodes, an atom of oxygen is taken, from the other extremity, an atom of hydrogen: while at the moment of the escape of these terminating atoms, by a series of decompositions and recompositions, the intermediate atoms of the row re-arrange themselves as atoms of water, so as to take in the residual atom of hydrogen at one end, the residual atom of oxygen at the other end. The removal of an atom of hydrogen and an atom of oxygen from a row of aqueous atoms by this process, is equivalent to the loss of one atom of water, which cannot sensibly affect the remaining portion of the liquid consisting of an immense number of such rows, any of which may successively become the medium of the electrical current.

It is remarkable that after admitting that the rationale which I have given, is consistent with one of his imaginary cases, Mr. Phillips should consider it an objection that it would not comport with two other cases, which, by his premises, may never exist. But even if his cases had other than imaginary existence, I assert that sodium and oxygen must be just as capable of performing the requisite part in any of them, as oxysulpion and sodium.

I am unable to understand how the "*destruction*" of an equivalent of sulphate of soda should be followed by any consequence which would not equally follow the "*destruction*" of an atom of oxysulphionide of sodium; and wherefore free sulphuric acid, while called sulphate of water, should be more prone to react with oxide of sodium, than if it were to receive the new appellation of oxysulphionide of hydrogen.

As to my theory not embracing the fact of "*the transfer of acid and alkali*," I have shown in my letter to Professor Daniell, published in the *Philosophical Magazine* and *Journal* in August last, that, agreeably to neither theory, should there be any such transfer. The electrolytic process, agreeably to Faraday, does not cause any transfer. In order for acid or alkali to appear at any point, there must have been previously at that point a suitable electrolyte so situated as to be acted upon by the voltaic current.

According to either view, for each atom of oxysulphionide of sodium, or for each atom of oxide of sodium, an atom of oxygen and free sulphuric acid appearing at the anode, and an atom of hydrogen and free soda at the cathode, I cannot understand how the gaseous products can vary so as not equally to justify either method of grouping the elementary atoms concerned.

Mr. Phillips proceeds to say, to use his own words: "As to the oblique, and what I may call chemical evidence, brought forward by the American professor in defence of his views, it is now, I think, useless to meddle with them, such reasons, both for and against,

may evidently be regarded as equal, which may be proved by the fact that such arguments have been in the possession of chemists for many years, and yet they could never bring themselves to think alike on the subject." When the evidence actually adduced by an author is designated as "*oblique*," it may be difficult to prove that obliquity exists only in the mental vision of the critic; but fortunately, in my case, the word oblique is evidently inapplicable, since I have adduced *no* evidence. If there be any obliquity in the facts of which I availed myself, let the blame attach to Kane, Graham, Daniell, and others, who referred either to the same or analogous facts, in the first instance, as forming a basis for a series of arguments in favor of the existence of salt radicals. Referring to the same, or to analogous facts, I endeavored to counteract these arguments. This has appeared to be equivalent to adducing "*oblique evidence*" in the mind's eye of Mr. Phillips, who does not perceive the difference between reasoning on undeniable facts already before a tribunal, and the advancement of new evidence exceptionable from its obliquity.

I am afraid that Mr. Phillips has answered my arguments without reading them; that he has not understood them is quite evident from his confounding them with the idea of "oblique evidence." If, as alleged in the passage above quoted, the arguments in favor of the old view are equal to those advanced in favor of the new, then there is no justification for a change; and the learned and skilful Dr. Kane has, according to Mr. Phillips, taken *much pains to no purpose*. The object of most of my arguments was to show that the facts were as consistent with the existence of acids and bases, as with the existence of salt radicals in union with metals.

But there is one of the phases of this question, in which there is no equality in the arguments in favor and against the existence of salt radicals. The new doctrine requires that all the binary compounds, formed with halogen bodies, should be treated as salts, and their compounds as double salts; while the analogous amphide compounds are excluded from the class of salts, and the compounds which they form with each other are deemed to be simple salts, consisting of a compound radical and a simple radical. Of course it requires that a line of demarkation should be pointed out, by which the halogen bodies and their binary compounds should be distinguished from amphigen bodies and their binary compounds. I will thank Mr. R. Phillips to answer the arguments which I have advanced, in order to prove that no such line of demarkation can be drawn; and that of course the new doctrine must be abandoned as respects one class, or extended to the other. (See paragraphs 21 to 29 of my Essay in THE CHEMIST for November, page 489.)

But to narrow the question, I request Mr. Phillips to show me wherefore the chlorohydric, bromohydric, iodohydric, fluohydric, and cyanhydric acids are to be deemed salts, while the oxhydric* water, which acts both as an acid and base, sulphydric,† selendric, and telluhydric acids are not to be so considered. Let him say on what account the compound of fluohydric‡ acid with fluoride of potassium is a double salt ($FH + FP$), while that formed by sulphydric acid with the sulphide of potassium§ is a simple salt having a compound radical SH^2, forming with its radical SH^2P.‖

As I have been unable to hear from any American chemist any objections to the arguments which I used in my attempted refutation, I pray Mr. Phillips to enlighten the darkness which prevails on this subject throughout this portion of the western scientific world: and, since he has alluded to certain "*equal reasons*," that he will have the goodness to make us acquainted with those reasons.

ON THE PRODUCTION OF A NEW AMIDE BY THE ACTION OF AMMONIA ON OIL AND FAT.¶

BY M. P. F. G. BOULLAY.

I HAVE often been occupied with the ammoniacal soap whose imperfect production was daily operated under my eye, when, in 1829, I tried experiments with a direct object. I wished to study this kind of combination, to ascertain if there were any real and complete action, and if ammonia could, in these circumstances, be assimilated with other alkalis: some circumstances gave rise to some doubts in my mind on this subject.

I was supported, however, by the conclusions of M. Chevreul, who so clearly and successfully developed the phenomena of saponification, and so carefully studied the new bodies which result from it.

However, M. Chevreul limited his investigations concerning the ammoniacal soaps,

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* Steam. † Sulphuretted hydrogen.

‡ Hydrofluoric. § Sulphuret of potassium.

‖ See an Essay of my esteemed friend, Walcot Gibbs, in Silliman's *Journal* for January last. (See paragraphs 12 to 15 of my Essay in THE CHEMIST for October last.)

¶ *Journal de Pharmacie*, May, 1844.

and, admitting an analogy of reaction, he concluded that ammonia in the caustic state and the basic carbonic, at the ordinary temperature, saponified fat only with much difficulty.

Alcohol, saturated with ammoniacal gas,* was an agent which I wished to apply to other uses: first, to compose a kind of transparent *Eau de Luce*, and to substitute it for the milky mixture for which so many formula have been given; and, again, to be able to present the volatile alkali aromatised with all kinds of essences without causing it to lose its transparency. This succeeded; but I discovered a new course to be followed for studying the action of ammonia on the volatile oils which undergo by time, in these mixtures, a peculiar and remarkable alteration.

I had the idea of saponifying olive oil by gradually adding it, at a temperature of from 64° to 68°F., in a corked flask containing ammoniacal alcohol. By agitation a portion of the oil was speedily dissolved; I continued to add as much as could be absorbed. The liquor retained its transparency, acquired a yellow tint, and was left in this state.

During the following winter, I remarked silky crystals deposited in the flask; but they were so light and in such small quantity, that I neglected to collect them.

On the other hand, in order to try the saponification by a different means, I exposed fat, whose fluidity was maintained at a gentle heat, to the action of a current of ammoniacal gas. This operation was connected with the preparation of volatile alkali for my shop. The fat, although melted, acquired opacity, but it did not present the characters of a true soap; it was kept in a sealed flask, and left thus for a great number of years, as well as the ammoniaco-alcoholic solution of olive oil, which, in summer, resumed its transparency, and, in winter, again deposited the white and crystalline matter which I have mentioned.

I placed olive oil in the same condition as the fat; the mixture became of a perfect dead-white. Finally, I likewise set aside a mixture of equal parts of olive oil and liquid ammonia.

These products and many others were left to themselves, because, being occupied with other subjects, I had entirely left off working in the laboratory, retaining, however, the elements of a host of investigations formerly commenced.

I endeavored, some months ago, to resume this work, being struck with the appearance acquired by the mixtures in question, all of which had undergone an action which time seemed to have rendered as complete as it was possible to hope for.

I should not, doubtless, have dared to make this new attempt in the progressive field of science, if my excellent friend, M. Dumas, to whom I had presented my products and submitted my views, had not encouraged me and promised to guide me in the delicate experiments, and particularly in the elementary analyses which my work required, and which were made under the supervision of that chemist.

OIL SOAP.

The ammoniacal soap, that is to say, the compound resulting from a current of ammoniacal gas through olive oil, or that which results from the solution of the oil in ammoniacal alcohol, or even the simple mixture of oil and liquid ammonia, kept since 1829, in stoppered flasks, was of a perfect white.

Its reaction is alkaline; this property is lost when it is exposed to a temperature of about 86°F., until the ammoniacal odor is entirely dissipated. The matter then gives signs of acidity.

It mixes in cold water without being dissolved in it. It completely and very easily dissolves in boiling alcohol. There is deposited, by cooling, a silky matter, crystalline without any well determined form, white and transparent, unctuous and soft to the touch, which, collected on a filter and well washed with distilled water, was neither perceptibly acid nor alkaline.

The alcoholic mother-liquor was slightly yellow and acid. It contained, besides a new quantity of neutral matter, fatty acids, more soluble in cold alcohol, an organic acid (not fatty) which appears new, glycerine, and a yellow coloring matter.

If the intact soap be boiled with 30 or 40 times its weight of distilled water, the liquor becomes milky, and foams like a true solution of soap. After cooling, a matter of the appearance of fat or wax is collected and congealed on the surface; it is slightly acid, still potassa disengages from it traces of ammonia.

The ammoniacal soap, thus washed with warm water, was treated by boiling milk of lime; a lime soap was formed, from which alcohol removed the white crystallisable and neutral matter above mentioned. In this case it still retains traces of margarate and oleate of lime, which must be separated by successive crystallisations.

The most simple means of obtaining this new principle completely free from extraneous matters, is to produce it by the slow action of

* 1,500 grammes of alcohol at 30° absorb about one-third of their weight of ammoniacal gas. I have not remarked any reciprocal action between these two agents.

ammoniacal alcohol on the oil. On afterwards concentrating the liquor, or simply exposing it to artificial cold, it allows silky crystals to deposit, which may be purified by redissolving in alcohol and by recrystallising them; then all the other products of the reaction are found in the alcoholic liquor.*

The filtered decoction is acid; lime and potassa disengage ammonia from it; it is reduced by evaporation into a yellow, syrupy liquid, which, redissolved in alcohol at 90°, yielded to it, besides glycerine and the coloring matter, a super-salt composed of ammonia and the peculiar acid already mentioned, which crystallised by cooling.

FAT SOAP.

The ammoniacal soap resulting from the action of a current of gaseous ammonia through pure lard kept in fusion, and, like the foregoing, made in 1829. Kept in a flask simply corked, its color was fawn yellow, and its consistence intermediate between fat and suet; it reddened litmus paper; potassa and lime developed ammonia. A portion of the ammoniacal fat soap was decomposed by a very dilute solution of oxalic acid, in slight excess, and heated; the fatty body which separated, cooled and washed several times with boiling distilled water, was afterwards dissolved in alcohol with heat. By the cooling of the alcohol, a confused crystalline mass was formed, of still impure fatty matter, but entirely similar, when deprived of fatty acids, to that which we have already described.

By water and long-continued boiling, the fat soap melted into a sort of deep yellow oil, and ammonia evaporated. A portion of this fixed matter, collected from the decoction, well washed, treated directly by alcohol, gave the same results as that which was treated by an acid. The new fatty body may therefore be directly obtained like oil, with the exception of removing from it, by baryta or lime, the organic acids which accompany it, and which are found in but small proportion.

As to the decoction, it was much more colored and more acid than that of the oil soap; by evaporation to dryness, and afterwards treated by alcohol, it was extracted, and in greater proportion than in the soap of oil: first, the same organic acid (not fatty), precipitating acetate of lead and nitrate of silver, but not lime and baryta water. This acid differs from sebacic acid, which it resembles, but with which I cannot absolutely compare it; second, the yellow coloring matter, also more abundant; third, much glycerine.

At the same time that I discovered this new principle in the ammoniacal soaps, M. Lassaigne, on his part, met with it in the old ammoniacal liniments of the veterinary pharmacy of Alfort. He immediately availed himself of it for trying a process for detecting the presence of nitrogen in organic matters. M. Lassaigne, not having been able to follow with me the chemical examination of this body, which was connected with a general and long commenced work, the further study of it was reserved to me. I therefore sought to characterise it, and to determine its nature, in order to assign to it, among the products of the organic kingdom, the place which it ought to occupy.

This matter, obtained pure, then melted and dried in the sand-bath, submitted to analysis, by means of oxide of copper, gave the following results:—

ORGANIC ANALYSES.

	Water.	Carbonic acid.
A. 0·761 of matter furnished	0·895	2·112
B. 0·792 ,, ,,	0·9195	2·202

ESTIMATION OF NITROGEN.

	Cubic centimetres.	Temperature.	Barometer.
A. 0·470 matter	21·5	54·5° F.	0·751
B. 0·450 ,,	20·5	55·0° F.	0·750

Which furnishes per cent.:—

	According to analyses. A.	B.	According to the formula.
Hydrogen....	13·05	12·88	13·0
Carbon.....	75·63	75·81	75·8
Nitrogen	5·33	5·31	5·2
Oxygen.....	5·99	6·00	6·0
	100·00	100·00	100·0

A result which agrees perfectly well with the formula in equivalents:—

$$C^{134}\ H^{33}\ O^{2}\ (N\ H^{2}),$$

representing margaramide—that is to say, margarate of anhydrous ammonia, minus 1 equivalent of water, furnished by the combination of 1 equivalent of the hydrogen of the ammonia with an equivalent of the oxygen of the margaric acid.

Margaramide is a white, solid substance, unalterable in the air, perfectly neutral, insoluble in water, very soluble in alcohol and ether, especially with heat. These solvents abandon a portion of it by cooling,

* Heat is a powerful auxiliary which it is difficult to apply to the preparation of margaramide. I have produced this new body by mixing one part of oil or fat with fifty parts of liquid ammonia and stirring the mixture frequently. This means is not more prompt than by the reaction of ammoniacal alcohol; it would be more simple and more economical.

under the form of crystalline needles, if the crystallisation be slow and the liquor not too concentrated, or white translucid plates if the separation be sudden.

It is fusible at about 140° F., and burns, like fatty matters, with a fuliginous flame, without leaving any charcoal.

The dilute solutions of potassa, soda, lime, and baryta do not alter it; they act on it only when they are concentrated and boiling; ammonia is then disengaged, and a salt remains which presents all the characters of a true soap.

The acids act on margaramide only at a certain degree of concentration, and more actively by aid of heat.

Without heat, weak sulphuric acid seems to unite with margaramide, and the mixture assumes the appearance and consistence of a cerate. When concentrated, the same acid imparts to it a rose color. At 212° the solution is operated, and the color acquires intensity. The whole assumes the form of a mass by cooling.

Nitric acid, cold, is without apparent action; by boiling, it disengages nitrous vapors—the liquor froths and swells up. On cooling, the matter which has not been destroyed, collects on the surface; it has a pearly aspect, and its consistence is increased.*

Most of the fixed oils and fats are susceptible of undergoing, by the action of ammonia, the same kind of transformation. For example: oil of sweet almonds, put into ammoniacal alcohol, furnishes, in less time than olive oil, a greater quantity of margaramide.

Oil of colza, made cold and pure, the oils of walnuts and hazelnuts, are more difficult to decompose under the same influence, but they undergo it very well in a long time. The oil of white poppy seeds dissolves better than the foregoing in ammoniacal alcohol, communicating to it a very deep yellow color. At the end of a certain time, the bottom and the sides of the flask are covered with margaramide, and much oleïc acid is found in the liquor. Linseed oil acts in an analogous manner; these two kinds differ, as is known, in the properties of the oleïn which constitutes them.

There is an oil of a very peculiar nature, on which an analogous action is exerted, in a very marked manner. Castor oil dissolves in almost all proportions in ammoniacal alcohol. It is sufficient to leave to itself, for some days, a mixture of equal parts of these two liquids, for the operation to be effected; the liquor, in this short space of time, acquires a yellow tint, and, either by spontaneous evaporation to one-fourth, or by artificial cooling, there separates an abundance of a substance of a dead white, of an imperfect and confused crystallisation, which, when it is well washed, resembles margaramide in its essential characters. It has less consistence; it is more fusible and more soluble in alcohol and ether. The mother liquor from which it is separated, of a fine yellow color, contains, doubtless, ricinate and oleidate of ammonia, glycerine, and coloring matter. I consider this body as peculiar, and that it should be amide and ricinic acid. I have not yet been able to make the experiments necessary for proving it.

The volatile oils also undergo remarkable alterations when submitted to the action of ammonia. The effects of this alkali on the essences of cinnamon and cloves, observed by M. Bonastre, and since confirmed by M. Dumas, are already well known; as also are the results obtained by MM. Dumas, Pelouze and Cahours, with those of mustard, bitter almonds, and *gaultheria procumbens*.

The odor of essence of mint and that of ammonia are neutralised by prolonged contact. The mixture is turbid, and, after a long time, a flocculent matter is precipitated. By their mixture with this alkaline base, several others, that of tarragon among the number, lose all oily quality.

Essence of turpentine seems to have, in the principal point of view of this work, the greatest analogy with the fixed oils; it likewise assimilates a portion of the elements of ammonia, and there results, perhaps, an amide of a peculiar nature: at all events the phenomena which are produced deserve to be carefully studied.

The formation of margaramide presents the first artificial amide arising from fatty matters. It is connected with a theory already professed for some years by M. Dumas concerning the natural amides extracted from vegetables, such as the organic alkalis, which would result from the action of nascent ammonia on acids pre-existing to their formation, and belonging, probably, for the most part, to vegetable oils.

The following, on this subject, occurs in the work of this celebrated chemist, vol. v., page 728, *et seq.*:—"Only one of the elements of organic alkalis—nitrogen, appears

* If we could form margaramide abundantly by an economical process, and if it were wished to introduce into therapeutics, or into the arts, this peculiar fatty body, it would present a superior consistence to fat, and inferior to *suet* or wax, precisely what is desired for liniments or ointments: it has also the advantage of turning rancid less easily than analogous substances.

constant, and it is worthy of remark that its quantity is precisely that which would exist in an equivalent of ammonia: it might be thought, according to that, that these bases contain ammonia, and owe to it their alkaline characters; but this opinion cannot be correct; for it would require that the ammonia should be combined with another body, and that, however, it should not lose its own capacity of saturation, which could not be. Ten years ago, in my lectures, I compared the organic alkalis to urea, and I see no reason for changing this view. Like them, urea forms definite salts; it presents an analogous composition, and perhaps an analogous capacity of saturation. I should therefore be inclined to regard the organic alkalis as amides, resulting from the action of ammonia on acids pre-existing to their formation. We are now acquainted with neutral amides and acid amides; nothing is opposed to the formation of basic amides."

From the facts laid down in this memoir, I think I am authorised in concluding—

1st. That the action of ammonia on oils and fats is in general slow and difficult, because it cannot be aided by a high temperature, and because it can be completely operated only at the end of several months.

2nd. That there results from it, in very small proportion, margarates and oleates, a peculiar acid in the state of super-ammoniacal salt, glycerine, and a coloring matter; but more particularly an entirely neutral body, having all the characters of an amide, and presenting the composition of *margaramide.*

3rd. That castor oil, in particular, is almost entirely converted, under the influence of ammonia, into a neutral body, analogous to that which the other fixed oils furnish, but with different characters.

ON THE OXYGENOUS COMPOUNDS OF GOLD, WITH INVESTIGATIONS CONCERNING THE PURPLE OF CASSIUS AND FULMINATING GOLD.*

BY M. L. FIGUIER.

PROTOXIDE OF GOLD.

ACCORDING to the investigations of Berzelius, all chemists have described the protoxide of gold as a green powder of extreme instability. These characters do not belong to the protoxide of gold, and I will show, in my memoir, that Berzelius has not obtained pure protoxide of gold, but, indeed, a mixture of much metallic gold with that compound.

The protoxide of gold is a powder of a violet color, or deep in the hydrated state that it appears black; when dried, it presents the violet blue color of the purple of Cassius. Chemically, it is an indifferent compound which can combine with acids and bases. The hydrogenous acids produce with it a deposit of gold, dissolving the tritoxide formed; ammonia gives with it a violet and fulminating compound. It is decomposed at 482°F. Far from presenting the extreme instability which Berzelius attributed to it, the protoxide of gold is, on the contrary, the least alterable of all the oxides of that metal.

The protoxide had hitherto been obtained only by decomposing protochloride of gold by potassa; but it is formed in a great many other circumstances which I will briefly point out.

Thus, the neutral trichloride of gold, treated by protonitrate of mercury, gives a violet-black precipitate of protoxide of gold. Boiling acetic acid, in reacting on protoxide of gold, partially reduces the latter to the state of protoxide. The acetate, tartrate and citrate of potassa, and generally the salts of organic acids, under the influence of a slight excess of free alkali, produce by ebullition a violet-black deposit of protoxide of gold. When the tritoxide of gold is boiled with caustic soda or potassa, a deposit of protoxide of gold is obtained which goes on increasing as ebullition continues. The chloride of gold acts in the same manner with caustic soda and potassa. Finally, the alkaline carbonates or bicarbonates produce with chloride of gold the same reaction. The protoxide of gold could be easily analysed by the simple action of heat.

PERAURIC ACID.

I admit as very probable the existence of an oxygenous acid of gold, more highly organised than all the combinations of this kind, soluble in water, or at least in acidulated water, and which should constitute peraurie acid, if my investigations on this point are confirmed by further experiments. The following are circumstances in which this compound appears to me to be formed. When we heat, as I have already mentioned, tritoxide of gold with caustic potassa, after a rather long boiling, an abundant precipitate of protoxide of gold is formed. As, in this case, no trace of oxygen is disengaged, and as the caustic alkali is found absolutely free from all organic matter capable of reducing the tritoxide of gold, it must be admitted, I think, that a more oxygenous compound of gold is formed, which remains dissolved in the potassa. This is, indeed, what is observed when the alkali is

* *Comptes Rendus*, No. 18, 1844.

saturated with nitric or sulphuric acid: the addition of the acid determines the separation of the undecomposed tritoxide of gold; carbonic acid only is disengaged, and the filtered liquid remains of a deep yellow color. This liquor in a few moments presents evident signs of decomposition; it promptly turns green, becomes turbid, and deposits gold. It is sufficient to heat it to 140 or 150°F. to see this phenomenon produced, and the deposit of gold accompanied by infinitely small gaseous bubbles. This phenomenon may also be observed in employing ordinary chloride of gold. After having boiled its solution to which potassa has been added for a sufficiently long time to furnish an abundant deposit of protoxide of gold, the liquor is precipitated by chloride of barium, and afterwards by baryta-water. A precipitate is formed which is at first yellow, and then greenish; this precipitate being treated by sulphuric acid, the tritoxide of gold remains in the insoluble state mixed with sulphate of baryta, and the filtered liquor contains the compound in question.

It seems to me very natural to conclude, from the foregoing facts, that the tritoxide of gold is converted, in this case, into protoxide of gold, and a new acid, more oxygenous than the tritoxide, and presenting extreme instability. It is precisely this remarkable alterability which hindered me hitherto from making a more complete study of this compound. I will shortly resume these investigations.

INTERMEDIATE OXIDE OF GOLD.

Guyton, Oberkampf, and Berzelius admit the existence of an oxide of a purple color. Berzelius, who examines this question at some length in his "Treatise on Chemistry," represents its probable composition by the formula $Au^2 O^2$. Not being able to detail here the very various investigations which I made on this subject, I will only observe that, after having repeated all the experiments of Guyton, Oberkampf, and Berzelius, I am convinced that, in all the reactions adduced by the latter chemist in favor of the existence of his intermediate oxide, no oxide of gold is formed; it is always metallic gold which is produced; only gold affects, in these cases, the purple or rose purple tint which it affects when reduced to its greatest state of division.

PURPLE OF CASSIUS.

From my investigations concerning the purple of Cassius, it results that this compound, so often studied by chemists, is a perfectly defined combination of protoxide of gold and stannic acid, or peroxide of tin. We will immediately give positive proof in this respect. It consists in showing that the purple of Cassius is produced from all pieces, when protoxide of gold and peroxide of tin are put in contact. It is sufficient for the experiment, to boil, for a few minutes, protoxide of gold, with a solution of peroxide of tin, in potassa. The purple of Cassius is immediately formed, and analysis indicates in this compound the constitution which we will soon make known.

Moreover, reagents demonstrate in the purple of Cassius the existence of peroxide of tin, without any trace of protoxide. Thus, hydrochloric acid and caustic potassa remove from the purple only peroxide of tin; we may add that the purple of Cassius and protoxide of gold are of entirely the same color.

It is known that all chemists who have analysed the purple of Cassius, have obtained numbers very different from each other. By making analyses of different purples, I never obtained numbers comparable among themselves, and representing a simple formula in equivalents; but, having had the idea of submitting these compounds to the action of boiling potassa, in order to examine the product, I ascertained that the potassa, without altering the primitive compound, removes from it a variable proportion of peroxide of tin, and allows the purple of Cassius to remain, with its ordinary properties analysed in this state; it constantly furnished numbers which correspond exactly to this formula:—

$$3\ (Sn^2\ O^2)\ Au^2\ O + 4\ HO.$$

It is exactly to this composition that I have been led in analysing the purple of Cassius, formed by means of protoxide of gold and stannate of potassa; and it is also this same constitution that I have ascertained in the purple of Cassius, which is formed by a very curious reaction, formerly pointed out by M. Pelletier, and which consists in throwing metallic tin into chloride of gold.

This formula, which seems at first not very admissible, enters however into the sphere of ordinary combinations, as will easily be perceived when it is recollected that M. Frémy, in his investigations concerning the metallic acids, showed that neutral stannic acid enters into neutral salts to the amount of three equivalents; so that the composition of the neutral stannates is not $St\ O^2\ MO$, but indeed $3\ St\ O^2\ MO$.

It is evident, therefore, that the purple of Cassius really represents the neutral stannate of protoxide of gold. This constitution, which I assign to the purple of Cassius, is confirmed by the existence of a corresponding compound, which contains precisely twice as much oxide of tin, and which represents, according to that, bistannate of protoxide of gold.

Indeed, Berzelius made the analysis of the purple of Cassius prepared with the solution of tin in nitro-muriatic acid, and found for its composition numbers, which, calculated in the idea of the existence of protoxide of gold, lead to this formula :—

$$6\,(St\,O^{\cdots})\,Au^2\,O\,7HO.$$

TRITOXIDE OF GOLD.

I notice, in my memoirs, various new peculiarities relative to protoxide of gold (auric acid). Not being able to detail here these results, on account of their diversity, I will content myself with saying a word concerning a new process for the preparation of this compound. This process consists in very accurately saturating neutral chloride of gold by carbonate of soda, and boiling until precipitation ceases. In this first treatment almost all the gold is obtained in this state of oxide. To extract, in this state, the rest of the metal, the liquor is supersaturated by carbonate of soda, in order to form aurate of soda, which, neutralised by sulphuric acid with the aid of heat, allows the remainder of the oxide of gold to be precipitated. The filtered liquor passes through entirely colorless, which shows that it contains only an insignificant quantity of gold.

FULMINATING GOLD.

Two opposite theories exist concerning the internal arrangement of the elements of fulminating gold : in the one, first enunciated by Pronst and Berthollet, this compound is regarded as a pure and simple combination of oxide of gold and ammonia ; in the other, proposed in 1830, in a work by M. Dumas, fulminating gold is regarded as a combination of nitroguret of gold and ammonia, the nitroguret of gold acting the part of an acid. In my opinion, the old opinion of Pronst and Berthollet is most in accordance with facts. The circumstances which lead me to think so are the following :—1st. As many kinds of fulminating gold may be obtained as there are oxides of gold known, there must, therefore, be admitted, in the opinion of M. Dumas, as many corresponding nitrogurets ; now, hitherto, no combination of gold with nitrogen has been realised. 2nd. The different kinds of fulminating gold present identically the color of the oxide of gold which gives rise to them, which leads to the belief that in these combinations, the oxides of gold undergo no alteration in their nature, 3rd. The analyses made by M. Dumas entirely agree with this point of view. Thus M. Dumas represents the constitution of the fulminating gold obtained by the tritoxide of gold by the formula

$$(Au^2\,N^2) + (NH^3) + H^3\,O^3$$

It is clear that this formula corresponds with the following—

$$Au^2\,O^3 + 2\,(NH^3),$$

that is to say, a subaurate of ammonia.

Finally, that fulminating gold obtained by chloride of gold furnished M. Dumas, for gold and nitrogen, numbers in hundredths which correspond to the formula

$$Au^2\,O^3 + 2\,(NH^3) + HO,$$

that is to say, to the foregoing hydrated compounds.

THEORETICAL EXPLANATION OF THE PHENOMENA OF WATER-GILDING.

I present in my memoir the theoretical explanation of all the phenomena which are observed in the curious processes of this branch of industry, which I owe to the kindness of M. de Ruolz, so as to be able to follow and examine in its details ; I must here confine myself to saying that this theory completely differs from that which has been generally admitted.

ON THE CHLORATES.*

BY ALEXANDER WAECHTER.

The combinations of chloric acid with bases have not, with the single exception of chlorate of potassa, been submitted, with regard to their properties and composition, to so profound an examination as the combinations of so important an acid merit.

In 1802, Chenevix presented to the Royal Society of London the first work on this subject. He prepared the chlorates which he described by the action of gaseous chlorine on the metallic oxides in solution or suspension in water ; however, he obtained them thus in such small quantities, and in a state of such imperfect purity, that he could not at all guarantee the data of their physical properties. He especially demonstrated by his investigations that certain combinations, such as corrosive sublimate, the metallic *butters*, &c., which were previously taken for chlorates, are metallic chlorides. After Gay Lussac had prepared, in 1814, aqueous chloric acid in a state of purity, Vanquelin resumed Chenevix's labors, and showed that the chlorates produced by the direct combination of chloric acid with metallic oxides were identical with those which Chenevix had prepared by another way. As the process which he followed furnished them to him in a greater state of purity than his predecessor had been able to attain, he corrected, in several respects, the data of the latter, con-

* *Journal für Praktsche Chemie*, vol. xxx.

cerning the properties of these salts; however, he made absolutely no investigation concerning their composition. The object of the present work is to fill up this vacuum.

CHLORATE OF SODA.

$SoO\ ClO^5$.

The crystalline form of chlorate of soda belongs to the regular system. The ordinary form is a cube with tetrahedral surfaces. It is soluble in three parts of cold water, and in less of warm water; but it is only very sparingly soluble in alcohol. When heated, it melts at nearly the same temperature as the salt of potassa; it then disengages oxygen, like the latter, and leaves a chloride of sodium with an alkaline reaction. The chlorate of soda is anhydrous, and formed of—

29·31	parts of soda.
70·69	parts of chloric acid.
100·00	parts of chlorate of sodium.

CHLORATE OF LITHIA.

$LiO\ ClO^5 + HO$.

I dissolved carbonate of lithia in pure aqueous chloric acid. The neutral liquor, evaporated over chloric acid, did not give crystals which could be recognised, but assumed the form of a radiated crystalline mass. In order to be able to study it, I pressed it between heated leaves of unsized paper; then I dried it completely over sulphuric acid. The chlorate of lithia, thus obtained, formed a white saline and very deliquescent mass; it fuses at 122° F., and, at 284° F., begins to abandon water, oxygen, and a little chlorine. If heated until no more gas is disengaged, a residue of chloride of lithium, with an alkaline reaction, is left. In order to determine the quantity of chlorine disengaged with water and oxygen, I fused 0·2836 gr. of the salt, until completely decomposed; the 0·1176 gr. of chloride of lithium, with a basic reaction thus obtained, gave 0·4030 gr. of chloride of silver. The loss of chlorine was therefore very slight. In order to determine the composition of the salt, 0·6700 gr. of chlorate of lithia were converted into chloride of lithium by hydrochloric acid; the latter salt was in its turn converted into sulphate; its quantity was 0·3655 gr. As the salt is a neutral one, the following composition results :—

Lithia	14·59
Chloric acid.....	76·31
Water	9·10
Chlorate of lithia..	100·00

This salt is very soluble in alcohol.

CHLORATE OF AMMONIA.

$NH^3\ ClO^5$.

I decomposed chlorate of baryta by carbonate of ammonia. The solution separated by the filter from the precipitate, furnished, by evaporation over sulphuric acid, prismatic crystals, whose form it was impossible clearly to determine, very soluble in water, and sparingly soluble in absolute alcohol. Vanquelin says that the salt volatilises below the boiling point of water; but this assertion is based in error. When heated, it suddenly decomposes at 215° F., and with an appearance of red light. The products of the decomposition are steam, nitrogen, chlorine, oxygen, hydrochloric acid, and hydrochlorate of ammonia. Mixed with combustible substances, it detonates with a shock like the salt of potassa. In order to determine the composition of the chlorate of ammonia, I evaporated and fused in a silver crucible 1·0635 gr. of salt with a solution of potassa, free from chlorine; I dissolved the fused mass in water; I supersaturated by nitric acid, and precipitated by nitrate of silver. I obtained 1·5005 gr. of chloride of silver. It was therefore—

Oxide of ammonium..	25·75
Chloric acid	74·25
	100·00

CHLORATE OF BARYTA.

$BaO\ ClO^5 + HO$.

I prepared this salt in greater quantity, in order to obtain pure chloric acid and several chlorates, by saturating with carbonate of baryta the impure chloric acid procured from chlorate of potassa by means of fluosilicic acid. It crystallises with a development of light. The most ordinary form is a rhomboïdal prism of 97° 39′, with two terminal surfaces equally inclined towards the axis, oblique under angles of 39° 48′. When heated, chlorate of baryta abandons its water of crystallisation at 248° F. (5·88 per cent.) It begins to abandon oxygen at 482° F.; it enters into fusion above 752° F., and then disengages all its oxygen with a trace of chlorine. If the elevation of temperature is rapid, it is suddenly decomposed with detonation. Mixed with combustible bodies, it is decomposed by a shock the same as the salt of potassa.

One gr. of salt, dried at 392° F., consequently anhydrous, was dissolved in water, and precipitated by sulphuric acid; I obtained 0·7717 gr. of sulphate of baryta. The composition of this salt is therefore—

Baryta	46·53
Chloric acid ..	47·59
Water	5·88
	100·00

In order to ascertain the quantity of chlorine which was disengaged with the oxygen when heated with chlorate of baryta, I mixed 1·7250 gr. of anhydrous salt with silica, recently heated to redness, and I decomposed it by heat; the loss was 0·5450 gr. It results that there was disengaged 0·0030 gr. of chlorine with oxygen; their disengagement was also detected in a sensible manner by the odor. Chlorate of baryta is soluble only in extremely small quantities, in absolute alcohol, and it colors the flame of alcohol of a deep green.

CHLORATE OF STRONTIA.

$$SrO\ ClO^5.$$

I dissolved carbonate of strontia in chloric acid; the solution gave, by evaporation over sulphuric acid to a syrupy consistence, large pyramidal crystals, which were not measured because they promptly became damp in the air. They were insoluble in alcohol; heated, they swell up without abandoning water, and fused almost at the same temperature as the salt of baryta. When very strongly heated, they abandoned their oxygen with a trace of chlorine, and a residue of chloride of strontia, with an alkaline reaction, was left. Mixed with combustible bodies, it detonated with a shock like chlorate of potassa.

1·0290 of the salt, dissolved in spirit of wine, gave, by their precipitation with sulphuric acid, 0·7400 gr. of sulphate of strontia. The salt is, then, formed of—

Strontia.....	40·71
Chloric acid ..	59·29
	100·00

CHLORATE OF LIME.

$$CaO\ ClO^5 + 2\ HO.$$

A neutral solution of carbonate of lime, in pure aqueous chloric acid, gave, by evaporation over sulphuric acid to a syrupy consistence, very well defined crystals of chlorate of lime. These are oblique, rhomboïdal prisms, with an oblique terminal surface. They could not be measured, because they very promptly deliqueseed in the air. They are very soluble in alcohol, and color its flame of a fine red. If very promptly heated to above 212° F., they fuse in their water of crystallisation; if, on the contrary, the temperature be slowly raised, they lose, without fusing, their water of crystallisation (14·10 per cent.); they are then anhydrous, and fuse only at a rather lower temperature than the corresponding combinations of baryta and strontia; they abandon, like the latter, oxygen, with a trace of chlorine, and leave a residue of chloride of calcium, with an alkaline reaction.

0·8950 gr. of the crystallised salt gave, by solution in water, and precipitation by carbonate of ammonia, 0·3700 gr. of carbonate of lime. The salt is, therefore, formed of—

Lime	23·36
Chloric acid ..	62·54
Water	14·10
	100·00

CHLORATE OF MAGNESIA.

$$MgO\ ClO^5 + 6\ HO.$$

The neutral solution of chlorate of magnesia, obtained by the decomposition of chlorate of baryta, by means of sulphate of magnesia, furnished, by evaporation over sulphuric acid, only a saline mass in crystalline plates, very deliqueseent, and very readily soluble in alcohol. In order to study it, I freed it from the mother liquors by pressure between heated leaves of blotting paper, and I then completely dried it over sulphuric acid.

Chlorate of magnesia fuses at 104° F., and begins at about 250° F. to abandon water, oxygen, and chlorine. When the heat is continued, the residue is a mixture of magnesia and chloride of magnesium; if it be heated very rapidly, magnesia alone remains.

1·003 gr. of chlorate of magnesia were decomposed by heat; the residue, converted into sulphate of magnesia, by the addition of sulphuric acid, was 0·510 gr. This chlorate is, therefore, formed of:—

Magnesia	13·77
Chloric acid	50·25
Water	35·98
	100·00

CHLORATE OF PROTOXIDE OF MANGANESE.

I have not been able to prepare this combination in the solid form. The colorless solution which is obtained by the decomposition of chlorate of baryta, by sulphate of protoxide of manganese is decomposed, by evaporation over sulphuric acid, and at a certain degree of concentration, into chlorine, oxygen, and hydrated peroxide of manganese. I must, therefore, confine myself to explaining the manner in which the diluted solution acts. It is not altered by boiling. The addition of dilute sulphuric acid colors it of a deep red; sulphate of manganese is then formed at the expense of the oxygen of the chloric acid. If a small quantity of the solution of chlorate of prot-

oxide of manganese be added to an excess of concentrated sulphuric acid, a brown crystalline precipitate is formed, which is an intimate mixture of peroxide of manganese and sulphate of protoxide of manganese insoluble in concentrated sulphuric acid.

CHLORATE OF PROTOXIDE OF IRON.

By the decomposition of a solution of protosulphate of iron, by means of another solution of chlorate of baryta without heat, a neutral, colorless solution of protochlorate of iron is obtained. However, it decomposes spontaneously, when the temperature is not very low; indeed, its neutrality changes; it deposits, at the bottom of the vessel, cinnamon-colored basic chlorate of peroxide of iron, and there remains a deep-red solution of chlorate of peroxide of iron and chloride of iron.

CHLORATE OF PROTOXIDE OF TIN.

Recently precipitated hydrated protoxide of tin is dissolved in aqueous chloric acid, forming a colorless liquor. However, it decomposed spontaneously in a few minutes with powerful detonations and elevation of temperature, and it gave rise, after the completion of the decomposition, to a gelatinous mass. The examination showed that the latter contained hydrated oxide of tin, chloride of tin, and much free chloric acid. 12 atoms $SnO\ ClO^5 = SnCl^2 + 11\ SnO^2 + 10\ Cl\ O^5$.

The detonations arise from the decomposition of a portion of chloric acid produced by the simultaneous elevation of temperature.

CHLORATE OF ZINC.

$ZnO\ ClO^5 + 6HO$.

The solution of chlorate of zinc, obtained by the decomposition of chlorate of baryta by sulphate of zinc, furnished, by evaporation over sulphuric acid, a very deliquescent crystalline saline mass, which was very soluble in alcohol. Chlorate of zinc fuses at 140° F., abandons chlorine, oxygen, and water at a rather higher temperature, and leaves, when the heat is sufficiently raised, pure oxide of zinc.

0·9655 gr. of salt, dissolved in water, were precipitated by carbonate of soda. The washed and calcined precipitate gave 0·22958 gr. The salt therefore contains:—

Oxide of zinc	23·72
Chloric acid	44·46
Water	31·82
	100·00

CHLORATE OF NICKEL.

$NiO\ ClO^5 + 6HO$.

The neutral solution of this salt, obtained by the decomposition of chlorate of baryta and sulphate of nickel, furnished, by evaporation over sulphuric acid, very fine regular octohedrons of a deep green color, which very speedily deliquesced in the air, and were very readily soluble in alcohol. At 176° F. they fuse in their water of crystallisation, and begin to be decomposed at 284° F., disengaging water, chlorine, and oxygen. If the temperature be not then raised beyond 392° F., we obtain as a residue, a black mixture of peroxide of nickel and chloride of nickel, which assumes, by heating at a slight red, a yellowish-grey color, and is then a basic chloride of nickel. If it be heated to redness for a long time, it is converted into pure oxide of nickel of a silver grey color.

1·4150 gr. of chlorate of nickel, dissolved in water, and precipitated by solution of potassa, with the aid of heat, furnished 0·3150 gr. of oxide of nickel.

The crystals were, therefore, formed of:—

Oxide of Nickel	22·50
Chloric acid	45·16
Water	32·34
	100·00

CHLORATE OF COBALT.

$CoO\ ClO^5 + 6HO$.

Chlorate of baryta was decomposed by sulphate of cobalt; the solution, separated by filtration from the sulphate of baryta, gave, by evaporation over sulphuric acid, regular octohedrons, but in combination with the cube. The crystals are extremely deliquescent, and very soluble in alcohol; they fuse at 122° F., and are completely decomposed at 212° F., disengaging chlorine, oxygen, and water, and leaving perfectly pure oxide of cobalt.

1·0015 gr. of chlorate of cobalt, dissolved in water and precipitated, at the boiling temperature, by a dilute solution of potassa, furnished 0·2270 gr. of oxide of cobalt. The salt is, therefore, formed of—

Oxide of cobalt	22·48
Chloric acid	45·18
Water	32·34
	100·00

CHLORATE OF COPPER.

$CuO\ ClO^5 + 6HO$.

The solution of this salt, obtained by the decomposition of chlorate of baryta and sulphate of copper, gave, by evaporation *in vacuo* over sulphuric acid, a deep green liquor of syrupy consistence, which assumed the form of a crystalline mass, by exposure to an intense cold. I only very rarely suc-

ceeded in obtaining well-defined crystals, which appeared to be regular octohedrons. The chlorate of copper is very deliquescent, and very soluble in alcohol; it fuses at 150° F., and begins to decompose at a rather higher temperature. Fused chlorate of copper resumes the solid form only at a much lower temperature (68°F.) than its point of fusion (150° F.), even when it has not undergone the slightest decomposition by heat.

If it be heated to 212°F., it disenages bubbles of gas; each of them occasions a slight detonation. When the decomposition is operated at as low a temperature as possible, there is obtained as a residue a green body, which is decomposed only at a temperature exceeding 500°F. It is insoluble in water, but very soluble in the dilute acids; the solution in dilute nitric acid does not give a precipitate with nitrate of silver; that in hydrochloric acid has a very powerful odor of chlorine. If powerfully heated, this combination disengages water, chlorine and oxygen, and leaves as a residue pure oxide of copper free from chlorine. The green body is, therefore, a hydrated basic chlorate of copper.

1·2140 gr. of chlorate of copper were dissolved in water and precipitated at the boiling temperature by a solution of potassa. I obtained 0·2850 gr. of oxide of copper; the salt is, therefore, formed of:—

Oxide of copper	23·45
Chloric acid	44·60
Water	31·95
	100·00

CHLORATE OF LEAD.

$PbO\ ClO^5 + HO$.

By saturating pure chloric acid with oxide of lead, a neutral solution of this salt is obtained; its concentration may be carried sufficiently far, without decomposition, over a spirit-lamp for it to crystallise by cooling. The crystals are rhomboïdal prisms with a right terminal surface. They are, at first, transparent and are very brilliant; but they speedily become dull and opaque in the air. They do not deliquesce, but they very readily dissolve in water and alcohol. Mixed with combustible bodies, they detonate with as powerful a shock as the salt of potassa.

At 302°F., they lose 4·59 per cent. of water; at 446°F., they are suddenly decomposed with a hissing noise; they then disengage chlorine and oxygen, and a black partially fused mass remains, which is a mixture of peroxide of lead and chloride of lead. If it be heated further, the latter is converted, disengaging oxygen, into a yellow, basic chloride of lead of uniform composition.

1·0900 gr. of chloride of lead gave 0·8200 gr. of sulphate of lead; the salt is, therefore, composed of—

Oxide of lead	56·92
Chloric acid	38·49
Water	4·59
	100·00

0·8700 gr. of basic chloride of lead dissolved in nitric acid, and precipitated by nitrate of silver, furnished 0·6400 gr. of chloride of silver; it was formed, consequently, of:—

Oxide of lead..	28·64
Chloride of lead	71·36 = Pb O + 2 Pb Cl
	100·00

In order to control this composition, 0·9850 gr. of chlorate of lead, deprived of water, were mixed with a weighed quantity of recently calcined silicic acid, and heated to redness. They then lost 0·3280 gr., which correspond exactly to a loss of 8-9ths of the oxygen contained in the chlorate of lead and of 1-3rd of the chlorine, as was also shown by the composition of the remaining chloride of lead.

CHLORATE OF SILVER.

$AgO\ ClO^5$.

By dissolving oxide of silver in pure chloric acid, a neutral liquor is obtained, which gives, by evaporation, well-defined prismatic crystals.

Chlorate of silver is anhydrous; it dissolves in about 5 parts of cold water, as well as in alcohol, without alteration; it fuses at 446°F.; it commences at 518°F., to disengage oxygen mixed with a trace of chlorine. When heated until no more gas is disengaged, chloride of silver is left as a residue. The disengagement of oxygen is much more easy and more rapid if this salt be mixed with oxide of copper or peroxide of manganese. If chloride of silver be very rapidly heated, it is suddenly decomposed with an explosion and an appearance of light. Mixed with combustible substances, it detonates with a much more violent shock than the salt of potassa. 1 gram. of chloride of silver gives 0·7500 gr. of chloride of silver; the salt is, therefore, formed of—

Oxide of silver	60·63
Chloric acid	39·37
	100·00

If chlorine be passed through water, holding oxide of silver in suspension, chloride of silver is, likewise, formed; only, if the current of chlorine be continued too long, this

is decomposed in such a manner that it disengages oxygen under the gaseous form, and forms chloride of silver and free chloric acid (not perchloric acid.) The action of hypochlorous acid on oxide of silver or on finely-divided metallic silver, does not furnish chloric acid, but a mixture of peroxide and chloride of silver.

AMMONIACAL CHLORATE OF SILVER.

$AgO\,ClO^5 + 2\,NH^3$.

By dissolving chlorate of silver in ammonia and evaporating the liquor, prismatic crystals of this salt are obtained, which are very soluble in alcohol and water. They fuse at 212°F., and lose their ammonia, so that if the heat has not exceeded 534°F., pure chlorate of silver remains. If they be rapidly heated, they decompose with an explosion and an appearance of light. The solution of this salt gives, by the addition of potassa, a grey precipitate of the fulminating silver of Berthollet. This salt is formed of—

Chlorate of silver	84·81
Ammonia	15·19
	100·00

CHLORATE OF PROTOXIDE OF MERCURY.

$HgO\,ClO^5$.

Recently precipitated protoxide of mercury was dissolved in chloric acid; the solution of sulphuric acid, furnished to the last drop beautiful prismatic crystals; but they promptly lost their transparency and their lustre, and became dull in the air. Water and alcohol readily dissolve, without residue, the unaltered crystals; they, however, dissolve those which are already altered, leaving a small white residue which becomes black by boiling. If this salt be triturated with water and chloride of sodium, a white precipitate is obtained and the supernatant liquor has a neutral reaction. The salt is, therefore, neutral chlorate of peroxide of mercury. When heated, it disengages oxygen at 482°F., and is converted into a mixture of red oxide of mercury and corrosive sublimate; the latter may be separated by sublimation at 563°F., and the first remains if the temperature does not exceed 697°F. If it be rapidly heated, decomposition takes place suddenly, and chlorine is also observed among the products of the decomposition.

By evaporating the solution of this salt to dryness in a sand-bath, and redissolving the crystalline mass in water, I obtained its insoluble modification, already described by Vanquelin, under the form of an insoluble white powder; triturated with chloride of sodium and water, it also gave a white precipitate of calomel (it was not, therefore, a basic salt), and it completely dissolved in acetic acid. All the mercury was precipitated in the state of calomel from the acetic solution by hydrochloric acid. It gave, by elevation of temperature, the same products of decomposition as the soluble crystallised salt. The acid liquor with which it was washed deposited, by evaporation, basic chlorate of deutoxide of mercury in crystals. Mixed with combustible bodies, the chlorate of protoxide of mercury makes as powerful an explosion as the salt of silver.

In order to determine the composition of the crystallised protochlorate of mercury, I precipitated 1·2010 gr. by chloride of tin, in order to arrive at the determination of the mercury: there resulted 0·8285 gr. of mercury.

In order to determine the chloric acid, I boiled 0·8590 gr. of the salt with a solution of caustic potassa, free from chlorine; I evaporated, in a silver crucible, the liquor separated by filtration from the precipitate, and I fused it; then I redissolved it, and precipitated by nitrate of silver, after having supersaturated it by nitric acid. 0·4345 gr. of chloride of silver were formed. The salt is, therefore, formed of—

Protoxide of mercury	73·63
Chloric acid	26·37
	100·00

CHLORATE OF DEUTOXIDE OF MERCURY.

$HgO^2\,ClO^5 + HO$.

The solution of red deutoxide of mercury in chloric acid, and the evaporation of the liquor in the sand-bath, furnished chlorate of deutoxide of mercury in small tabular crystals. These crystals were octohedrons with a predominance of a right terminal surface. When heated, they first disengaged water and afterwards oxygen; they were then converted into a mixture of red deutoxide of mercury and bichloride of mercury; the latter distilled at 563° F. When the salt was rapidly heated it was suddenly decomposed; there was also an appearance of chlorine among the products of decomposition. Mixed with combustible bodies, it ordinarily inflames during the mixture, but without detonation. Water decomposes it into a soluble acid salt and an insoluble basic salt. If it be triturated with chloride of sodium and a little water, deutoxido-chloride of mercury of a red color is separated, and the supernatant liquor has a neutral reaction. The salt is, therefore, basic.

In order to determine its composition, I dissolve 1·0800 gr. in hydrochloric acid, and precipitated by chloride of tin; 0·7202 gr. of

mercury resulted. The proportion of chloric acid was determined as with a proto-salt. 0·8690 gr. of the salt gave 0·4100 gr. of chloride of silver. The salt is, therefore, formed of—

Deutoxide of mercury	72·13
Chloric acid	24·91
Water	2·96
	100·00

CHLORATE OF CADMIUM.

$CdO\,ClO^5 + 2\,HO$.

The solution of this salt, obtained by the precipitation of chlorate of baryta by sulphate of cadmium, gave, by evaporation over sulphuric acid, prismatic crystals, very deliquescent and very soluble in alcohol. They fuse at 176° F., disengaging water, oxygen, and chlorine. When the heat has been very strong, the residue is a fused, grey mass, formed of a mixture of oxide and chloride of cadmium. If this residue be treated by water, it dissolves a portion of chloride of cadmium; the other remains and forms, by its combination with the oxide of cadmium, a white, insoluble basic chloride. However, the chloride of cadmium in it is so feebly combined with the oxide, that the carbonic acid of the air is sufficient for converting it into a mixture of carbonate of cadmium and chloride of cadmium; the latter may then be extracted by water.

2·730 gr. of chlorate of cadmium furnished 1·235 gr. of sulphuret of cadmium. The salt is, therefore, formed of—

Oxide of cadmium.....	40·56
Chloric acid	47·99
Water	11·45
	100·00

CHLORATE OF BISMUTH.

The solution of oxide of bismuth in chloric acid is decomposed by concentration *in vacuô*; there is then precipitated to the bottom of the vessel a basic chloride of bismuth, and hypochlorous acid is disengaged; it was, therefore, impossible to isolate chlorate of bismuth.

ON THE TORREFACTION OF ORGANIC BODIES.*

BY THE BARON DE REICHENBACH.

Parallel to dry distillation we find another similar metamorphesis of organic bodies—*torrefaction*.

The first comprises the alterations produced by a decomposing heat *in the absence of atmospheric air*; the second, those which take place *in its presence* and with its concurrence.

Chemistry has not, hitherto, submitted this vast field of phenomena to investigation. Researches of this nature must, as may be foreseen, embrace many questions, and are fraught with difficulties; and it is only with fear that I have endeavored to enter an unknown domain, and to take the first steps in it.

As this subject embraces all organic bodies, it must necessarily possess, in many respects, great scientific importance; but its practical value is scarcely less important in many respects. It comprises, among others, a great part of the alterations which alimentary substances undergo during their preparation, drugs, during the operations which they are made to undergo, and innumerable operations of agriculture, the arts, &c. The results of labors undertaken in this direction may, therefore, be fruitful if we are fortunate enough to overtake nature in the secret of its operations. The word *torrefaction*, taken in the broadest sense, is divided into several secondary acceptations: —*a*. When organic bodies are immediately submitted, to a certain moderate degree, to the action of the open fire, this operation is called *roasting*. Meat is roasted on a spit before the flame, chesnuts in live coal, and potatoes in hot ashes. *b*. If a body, an open metallic vessel, be interposed between the organic body and the fire, it is *torrefaction* in its least extended sense: coffee is heated in the drum, flour in an oven, sugar in a dish. *c*. If this operation be performed in close vessels, the action of the steam which the humid body abandons by heat is exerted concurrently with that of the air, and this operation is designated by the name of baking. Bread is baked in the oven, pies in metallic moulds, sugar in cylinders, &c.

All the phenomena of these operations have, hitherto, remained in obscurity. They surround us every day and every hour; we live in great measure on their products, and still their intimate nature is unknown to us. We are, indeed, but very imperfectly acquainted with the constitution of the beer which we ourselves prepare. We know not the phenomena which occur in the roasting of malt. Do we even know what bread is? Let us avow, with surprise, we do not know it in the strictness of the acceptation.

The state of alteration which bodies present to us when exposed to a high temperature with the concurrence of the air, the

* *Annalen der Chemie und Pharmacie*, vol. xlix., ch. 1, p. 1.

differences in color, odor, taste, and state of aggregation which they assume, manifestly point out to us the metamorphoses in the constituent parts, the decomposition of the former principles, and the formation of new ones.

The investigations which I undertook on this subject, at the conclusion of my former works on dry distillation, led me to the discovery of various new substances, of which I will successively give a description.

I. ASSAMAR.

Every one knows that the crust of bread, a little toasted, has a slightly bitter taste. Physicians prepare from it, for sick persons, toast-and-water, which has an agreeable slightly bitter taste; beer is, as is known, so much the more bitter, as the malt, with which it is brewed, has become more brown by desiccation; burnt crusts, burnt roast meat and its juice, have a powerfully bitter taste; fruits torrefied in sugar have a sweet and bitter taste, &c. All these organic bodies, turned brown by too high a heat, present a more or less marked bitterness, but so powerful an action is not necessary for producing it; a delicate palate recognises, even in the good crust of ordinary bread, a slight taste of bitterness, just sufficient to communicate to it an agreeable aroma.

The cause of all these bitternesses is a peculiar body, susceptible of being isolated, and whose preparation and properties I will here describe. I propose for this body the name of *assamar*, derived from *assa*, *assare*, to torrefy, to roast, and from *amarus*, bitter. I follow, for its denomination, the analogy of the word *picamar*, which I previously introduced into chemical nomenclature for the very different bitter substance contained in dry distilled tar; so that the denomination of assamar designates the bitter of *roast meat* as that of picamar designates the bitter of tar.

PROCESS OF PREPARATION.

The properties of this new body are of a nature to render a partial knowledge of them indispensable for understanding its preparation, especially on account of its intimate connections with many other bodies likewise unknown, and new to science. It will be best, consequently, first to point out the preparation in its general features, then to proceed to the exposition of the most essential properties, and afterwards to the peculiarities of the former.

If vegetable albumen, gum, gluten, sugar, starch, animal gelatine, coagulated blood—if animal albumen or meat, bread, &c. be torrefied on the fire, or on an iron plate in the open air, sufficiently long and powerfully for these substances to become brown or black-brown, they become hard, and may afterwards be broken and pulverised; some are softened, some even melt with heat, but, by cooling, they become hard, brittle, and susceptible of being pulverised. It is endeavored to shelter them as much as possible from the contact of the air during their pulverisation, in order to prevent the absorption of moisture. The powder of these substances is put into a cold place; absolute alcohol of the temperature of ice is poured on it, it is well stirred for some time with this liquid in a closed vessel, and the liquor is allowed to deposit and become clear. The alcohol has then removed a portion of assamar from the torrefied substance. It is drawn off clear; fresh alcohol is poured on the residue, and this operation is repeated several times in the same manner.

The solution obtained has a wine-yellow color; it contains only a limited quantity of assamar, mixed with various foreign bodies, which must be removed. With this view, the alcohol is first removed by distillation in a sand-bath. It is not completely disengaged, but there remains in the retort a thick syrupy mass; this is a tincture of assamar, which is not decomposed at the temperature of boiling water. A small quantity of water is then added, sufficient for removing the greater portion of the alcohol by the distillation, and to convert the alcoholic syrup into aqueous syrup; a slight turbidness is then produced.

The solution is allowed to cool very slowly; when the cooling is effected with sufficient repose in the space of 10 or 15 hours, a small quantity of fatty matter collects on the surface, which is afterwards removed quite congealed or dissolved in ether.

The mass then feebly reddens litmus paper. It is then heated with clear milk of lime until the acid reaction has disappeared; the mixture is then carried to ebullition. The liquor becomes turbid by the formation of a flocculent brown precipitate. Absolute alcohol is again added by small portions at a time. Every time that a milky precipitate is obtained, rapidly coagulating, the temperature is raised, and it is stirred until it disappears. Finally, when these clots no longer appear by boiling, but form a viscid deposit adhering to the sides of the vessel, no more alcohol is added. There must then be employed, in most cases, a quantity of alcohol amounting to 20 or 30 times that of the mass. The whole is then allowed to cool and settle slowly. In this case, the mixture at first becomes turbid, then gradually becomes clear, leaving a copious deposit on the sides of the vessel.

It is decanted and washed with alcohol,

There remains in the retort a thick layer, which is tasteless, or of a slightly bitter and sweet taste, which is easily removed by washing with water, and which is rejected. The last operation must be repeated once or twice; that is to say, it is necessary to remove the alcohol by distillation, to pour, by portions at a time, fresh alcohol on the remaining syrup, to redissolve by heat the milky precipitate if it be formed, then to allow the liquor to cool and clarify slowly, to reject the layer which is then formed, and to repeat this operation until cooling no longer causes turbidness or the formation of any deposit on the sides of the vessel.

Finally, the alcoholic liquor is mixed with a small quantity of hydrated ether; it is turbid and again produces a deposit on the sides of the vessel when it is powerfully agitated or slowly clarified by settling. If the viscid precipitate has a slightly sweet taste (this sometimes happens when saccharine substances are employed for torrefaction), a fresh portion of ether must be added in order to produce a new precipitate, and the operation repeated until it has a decided bitterness. The sweet precipitate no longer redissolves in cold absolute alcohol, whilst the bitter precipitate slowly but completely dissolves in it.

The latter is formed of a small quantity of assamar, and, if it appears pure, it is kept; but, if it is sweet, it is rejected. The alcohol and ether are then distilled (not evaporated), and a purified aqueous solution of assamar is obtained, which, by continuing the distillation longer in a sand-bath, may be brought to such a state of inspissation that, after cooling, it is impossible, or very difficult, to stir it. By cautiously heating it in small quantities at a time, it may be obtained dry and solid.

In all these operations, if it be wished to obtain as pure a product as possible, we must never work on an open fire, or in the air.

The following are the fundamental features of this process of preparation:—We begin by as carefully as possible getting rid of all the substances soluble in water, and we separate a gummy substance, a sweet substance, two fatty matters, two acids, and a mouldy body, all products of the torrefaction of organic bodies, which pass into the alcoholic solution of assamar. It will be understood, however, that this general process must be adapted, in special cases, to the particular nature of each compound substance which it is wished to employ, and which may contain principles not susceptible of torrefaction; a process applicable to all possible cases cannot, in fact, be given.

PHYSICAL PROPERTIES.

Assamar is a *solid, transparent, amorphous, amber-colored body.* It resembles gum in appearance; it is brittle, and easily cracks, by simple cooling, with a conchoïdal fracture of a vitreous lustre. Its odor is feeble; when it is evaporated by heat, it is slightly aromatic.

Its taste is decidedly bitter. However, this bitterness is neither powerful nor disagreeable, but it is always sweet in some measure, even when most concentrated. Whence it comes that the bitterness of all torrefied aliments, roasted or baked, provided that they be not burned, is not unpleasant, but always presents an agreeable aroma.

By an augmentation of heat, assamar fuses and becomes fluid; it swells up by cooling, even in small quantities. It is not volatile, but it decomposes by heat into other bodies, and the latter carbonise immediately. During the decomposition, and before the carbonisation, it disengages inflammable vapors which, in burning, give out an agreeable aromatic odor, which lasts for a long time.

Exposed to the air, it promptly attracts moisture, and very soon deliquesces. Its hygrometric energy is so great, that it removes water from spirits of wine, and becomes deliquescent in it when cold, whilst it slowly dissolves in cold alcohol, without being previously liquified. If torrefied bodies containing assamar be treated by spirit of wine instead of alcohol, and if the solution be distilled, the part of them which is not volatile remains in the residue—not in the state of spirituous solution, but in that of aqueous solution; assamar would remove water from spirit of wine, if the latter were sufficiently strong not to abandon it to itself.

The hygrometric nature of assamar essentially distinguishes it from the other products of torrefaction which accompany it, and the deliquescence of complex bodies everywhere detects its presence in them.

(*To be continued.*)

ON A NEW ORGANIC ALKALI.*

BY M. A. LAURANT.

I HAD the honor of addressing to the Academy, some months ago, a memoir on the products of the distillation of the nitrogenous and sulphurous compounds of the benzoïc series.

I have only just discovered that one of these products, *lophyle*, is a new alkali,

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* *Comptes Rendus*, No. 22, May 27, 1844.

susceptible of combining with most crystallisable acids.

Its composition should be represented by $C^{92}\ H^{34}\ N^4 = Lp$.

This alkali, which I will call *lophine*, presents some very remarkable peculiarities. Thus, it is not oxidised, and it contains 4 atoms of nitrogen; it has the highest atomic weight of all known bases, and, nevertheless, it may be distilled without being decomposed at a very high temperature. Its salts are soluble in alcohol, but insoluble in water.

The formula of the chloride is $H^2\ Cl^2 + Lp$;

That of the chloroplatinate $(H^2\ Cl^2 + Lp) + (Cl^4\ Pt)$;

That of the nitrate..... $NO^5\ HO\ Lp$.

The compound which I designate under the name of amaryle is only impure nitrate of lophine.

By distilling nitroguret of benzoïle, lophine and a new substance which I will call *amarone*, are obtained. It crystallises in needles, and is not decomposed by nitric and sulphuric acids, nor by the alkalis; only it forms with sulphuric acid a solution of a magnificent red color: one drop of water immediately destroys it, precipitating amarone from it. The formula of the latter is $C^{64}\ H^{22}\ N^2$.

ON THE DECOMPOSITION OF HYDRIODIC ETHER BY HEAT.*

BY E. KOPP.

Gay Lussac, in studying the reactions of hydriodic ether, remarked that this liquid, in passing through a tube heated to dull redness, gave rise to a solid matter, heavier than water and undecomposable by the caustic alkalis. All the derivatives of alcohol are of great importance in science, and the nature of this compound not having been determined, I thought that it would not be uninteresting to complete our knowledge in this respect. As to the proportion of hydriodic ether ($C^4\ H^{10}\ I^2$), the process which furnishes the most of it, consists in dissolving iodine in alcohol at 85 per cent., adding phosphorus until the color disappears, introducing a fresh quantity of iodine, then more phosphorus, taking care to cool the liquor so as to avoid too great an elevation of temperature. We continue thus until there is a disengagement of the phosphuretted hydrogen gas ($P^2\ H^3$) which is not spontaneously inflammable. By distilling, we obtain almost the whole quantity of ether indicated by theory. The residue consists of a very acid liquid (containing phosphoric acid, phosphovinic acid, and a little hydriodic acid), and of a solid, pulverulent residue of a deep red color.

This body, well washed, is insipid, inodorous, attracts oxygen but feebly from the air, and is nothing more than phosphorus in its red modification. It may be dried in the sand-bath, without being perceptibly oxidised; but it is difficult to drive off the last traces of moisture. Distilled, it turns black at first, and is converted into ordinary phosphorus, which condenses; at the same time a little phosphuretted hydrogen is disengaged, and there remains a slight residue of fused and colorless phosphoric acid, whose quantity, variable in different experiments, did not exceed 17 per cent. of the matter employed. Hydriodic ether, in passing through a long and very narrow glass tube, heated to dull redness, is in great part decomposed; inflammable gases, and which burn with a brilliant flame, are disengaged, and in a cooled receiver, a solid crystalline matter is condensed, colored of a red-brown by iodine. The gases, analysed by chlorine, gave, as a result, bihydroguret of carbon, CH^2, and hydrogen in the proportion of 2 volumes of the first, to 1 volume of the second.

In order to purify the solid matter, it is treated by a boiling solution of caustic potassa, the excess of iodine is removed, and the new product is precipitated to the bottom of the liquor, under the form of a yellowish, heavy oil, which solidifies by cooling. The liquor is decanted, and by dissolving the dried mass in boiling alcohol, a very beautiful crystallisation is obtained, in long, flexible, and slightly yellowish and very brilliant needles. Strongly pressed between folds of blotting paper, and exposed for some time to the air, they become entirely white, and present the matter in the pure state.

The density = 2·07; but it is difficult to obtain it accurately, since fused pieces always contain cavities. When heated, it melts at 158° F. into a yellowish liquid, which, when cooled, assumes the form of a crystalline mass, and takes a deeper and deeper reddish tint owing to the iodine set free. More strongly heated, it enters into ebullition, volatilises, and is partly decomposed; abundant vapors of iodine appear, and inflammable gases are disengaged: the brown sublimed product, treated by potassa and alcohol, reproduces the primitive crystals.

The matter is very soluble in alcohol and ether, with the aid of heat, but very sparingly so cold, which enables us to obtain beautiful crystallisations; it is insoluble

* *Comptes Rendus*, No. 19, May 6, 1844.

in water, and neither diluted acids nor alkalis sensibly alter it.

Concentrated nitric acid immediately disengages nitrous vapors, and liberates iodine.

Concentrated sulphuric acid attacks it only at a high temperature.

To determine the iodine, the fused matter is introduced into a long and very narrow tube, and it is passed in the state of vapor over iron turnings heated to redness. Iodide of iron is formed, which is decomposed by heat by a solution of caustic soda free from chlorides, by introducing iron turnings and the fragments of the tube itself in the alkaline liquor. After having filtered and washed the precipitate of oxide of iron, the solution, neutralised by nitric acid, was precipitated by the nitrate of silver.

I. 0 gr. 850 of matter gave 1 gr. 416 I^2 Ag=0·76277 of iodine.

II. 0 gr. 680 of matter gave 1 gr. 130 I^2 Ag=0·60871 of iodine.

III. 1 gramme burned by oxide of copper gave 0 gr. 140 of water, and 0 gr. 306 of carbonic acid.

	Calculation.		Experiment.		
			I.	II.	III.
I..	786·145	90·02	89·70	89·64	
C..	75·000	8·43	..	..	8·40
H..	12·500	1·55	..	..	1·57
	876·645	100·00			

The matter is therefore iodide of elayle (C^2 H^4 I^2), or hydriodate of iodide of aldehyden (C^2 H^4 I^2 + H^4 I^2), already so well studied by M. Regnault; its composition and properties prove their identity.

Experiments tried with the view of obtaining the cyanide of elayle (C^2 H^4 Cy^2) gave negative results.

By heating a mixture of iodide of elayle and cyanide of mercury, I obtained iodide of mercury (I^2 Hg), iodide of cyanogen and inflammable gases.

By dissolving the two salts in alcohol, a double salt is obtained, crystallisable in beautiful, white, fusible needles, which support a temperature higher than 176° F. without being decomposed. The products of its decomposition tend to prove that it is formed of C^4 H^8 I^2 + Hg Cy^2; for, by a high temperature, it is decomposed into iodide of mercury, iodide of cyanogen, a slight deposit of carbon and bihydroguret of carbon.

By heating C^4 H^8 I^2 with a very concentrated aqueous solution of potassa, the greater part distils without alteration; but one part is decomposed into iodine, which reacts on the potassa, and into the gas CH^2 which is disengaged.

By employing an alcoholic solution of potassa, a part of C^4 H^8 I^4 is decomposed, as before, into iodine and inflammable gas CH^2; but the greater part is converted into iodide of aldehyden, or of acelyde (C^4 H^6 I^2) and into H^2 I^2 which is combined with KO.

Iodide of aldehyden is easily obtained by precipitating with water the alcoholic liquid condensed in the well cooled receiver; C^4 H^6 I^2 is a colorless liquid, of a strong garlic odor, insoluble in water, very soluble in alcohol and in ether. It boils at 132° F.; its density is =1·98. Sulphuric, hydrochloric and nitric acids do not attack it cold. Fuming nitric acid decomposes it, disengaging iodine and red vapors.

0 gr. 850, burnt by oxide of copper, furnished—water 0 gr. 153, and carbonic acid 0 gr. 474.

		Calculation.	Experiment.
C^4..	300·00	15·66	15·20
H^8..	37·50	1·95	2·60
I^2..	1578·29	82·39	
	1915·79	100·00	

It is very easy to account for the differences of reaction observed in the composition of hydrochloric and hydro-bromic ethers, compared with that of hydriodic ether. Indeed, by virtue of the powerful affinity of chlorine and bromine for hydrogen, the two ethers, as M. Thénard has well observed, are decomposed into hydrochloric and hydrobromic acids, and into carburetted hydrogen gas, which are disengaged together, without being able to react on the others. Iodine having less affinity for hydrogen, the compound C^4 H^{10} I^2 is decomposed into free iodine and a mixture of 4 volumes of carburetted hydrogen (CH^2), and 1 volume of hydrogen. But iodine, in these circumstances, can combine with half of the carburetted hydrogen, and hence the formation of iodide of elayle (B^2 H^4 + I^2), whilst the remaining gases are disengaged.

ACTION OF AMMONIA ON BUTYRIC ETHER.*

BY M. G. CHANCEL.

M. Pelouze announced to the Academy the first results arrived at by one of his pupils, M. Chancel, in studying, at his request, some of the products derived from butyric acid.

The fermentation of sugar can now furnish this acid in sufficient quantity to allow of the different combinations to which it gives

* *Comptes Rendus*, No. 21, May 20, 1844.

rise being submitted to a profound investigation.

The author thought it would perhaps be interesting to examine the action of some agents on butyric ether, whose formation is so clear and so easy. It is known that oxalic acid gives, under the influence of caustic ammonia, oxamide, a substance discovered by M. Dumas, who has noticed it as a type of a series of combinations designated under the generic name of *amides*. It was probable that butyric ether would give rise to a similar reaction; experience completely confirmed these anticipations. The action of caustic ammonia on butyric ether took place, it is true, only slowly and with difficulty, but it was complete and gave rise to a substance which readily crystallised and which possessed all the characters of an amide.

BUTYRAMIDE.

Preparation.—When liquid ammonia and butyric ether are mixed, the latter at first gives a turbid and milky appearance to the liquid; but it soon separates and rises to the upper part. Nevertheless, at the ordinary temperature, taking care to agitate both liquids frequently, the butyric acid is decomposed. The layer diminishes from day to day; and, after a sufficient lapse of time, it completely disappears. By introducing into a well-corked flask, 1 part of butyric ether, and 5 or 6 parts of ammonia, the action, favored, moreover, by frequent agitation, is complete after 8 or 10 days; by then evaporating the liquid to one-third of its original bulk, the butyramide crystallises by the cooling of the liquor. This substance, therefore, is formed in the same circumstances as oxamide and succinamide, which have recently been discovered by Fehling.

Properties.—Butyramide crystallises in pearly tables, of a brilliant white; it is colorless, transparent, does not alter in contact with the air, and possesses a sweet and cooling taste, followed by a bitter after-taste. It melts, at a temperature of about 240°F., into a colorless liquid which, kept in fusion, slowly volatilises; the vapors are inflammable: it is, moreover, volatile without residue; it is readily soluble in water, and more so in warm than in cold water; it likewise dissolves in alcohol and ether. Thrown into water, it dissolves without producing those giratory motions common to several soluble butyrates; under the influence of the boiling temperature, the aqueous solution of butyramide is decomposed, by the alkalis, into ammonia and butyric acid. Thus, by adding hydrate of potassa, to a solution of butyramide in water, without heat, no appreciable disengagement is remarked; but, by ebullition, the latter is developed and disengaged for a long time in great quantity. The author has not, hitherto, submitted butyramide to the action of any other agent.

Composition.—The analysis of this substance furnished results which lead exactly to the following formula:—

$$C^8\,H^9\,N\,O^2 = C^8\,H^7\,O^2,\,N\,H^2.$$

From this, it results that the equivalent of butyramide is represented by the number 1089·54.

This composition, therefore, confirms, if that were necessary, the formula of butyric acid adopted by MM. Pelouze and Gelis.

The formation of butyramide in the circumstances just mentioned is expressed by the following equation:—

Butyric ether. Ammonia.

$$\overbrace{C^4\,H^5\,O,\,C^8\,H^7\,O^3}\ +\ \overbrace{N\,H^3} =$$

Butyramide. Alcohol.

$$\overbrace{C^8\,H^7\,O^2,\,N\,H^2}\ +\ \overbrace{C^4\,H^5\,O,\,HO}$$

The author intends to examine the action of dry ammonia on butyric ether, as well as the other products of decomposition to which various agents may give rise. If this study leads him to observations interesting to science, he will hasten to publish them.

EXTRACT OF THE REPORT OF THE FIRST CLASS OF THE ROYAL INSTITUTE OF THE NETHERLANDS, ON THE NUTRITIVE QUALITIES OF GELATINE: PRESENTED TO HIS EXCELLENCY THE MINISTER OF THE INTERIOR.*

(*Concluded from page* 215.)

All this seems to prove that we are right in mistrusting gelatine as nourishment; the commission, however, thought it ought not to regard it so. It was surprised to see that the second dog, which had received only 0·125 of bread, had not lost more than the two other dogs to which a greater quantity of animal substance had been given. It wished to know if it could obtain another result by adding to the 0·125 of bread, with which the dog had been nourished all this time, the 0·500 of gelatine which had previously been given to the other dogs. Thus all three were nourished, during 8 days, with 0·125 of bread and 0·500 of gelatine; the result was that, after this time, their weight remained the same, so that the addition of 0·500 of gelatine did not appear to have

* *Comptes Rendus.*

done any good to the second dog. The quantity of gelatine was then doubled, and, as a point of comparison, the other two dogs, were fed with bread and meat in smaller quantities. The result, after a week, was :—

	Dates.	Nourishment.	Weight.
1st Dog	Jan. 31	Meat .. 0·500, Bread .. 0·125	5·50
	Feb. 8...	*Idem*	5·75
2nd Dog	Jan. 31	Gelatine 1·000, Bread .. 0·125	6·50
	Feb. 8 ..	*Idem*	6·50
3rd Dog	Jan. 31	Meat .. 0·250, Bread.. 0·125	6·00
	Feb. 8...	*Idem*	6·50

Thus, notwithstanding a very large dose of gelatine, the second dog had not gained in weight, whilst the first dog, receiving only half of the proportion of raw meat, and the third dog receiving only one-fourth, each gained in weight. It was astonishing that the first dog, which had a greater ration of meat, at least gained less than the third, if it had not been remarked that it commenced to suffer from a disease of the skin, so frequent in animals which are ill fed. As this disease would render the ulterior results uncertain, it was no longer used, but the experiment was repeated with the other two dogs, although in an opposite direction.

	Dates.	Nourishment.	Weight.
2nd Dog	Feb. 8	Meat ... 0·500, Bread... 0·125	6·50
	Feb. 15	Meat... 0·500, Bread... 0·125	7·25
3rd Dog	Feb. 8	Gelatine 1·000, Bread .. 0·135	5·50
	Feb. 15..	*Idem*.....	6·50

Then the second dog, receiving, instead of 1·000 of gelatine, 0·500 of meat, increased, in the course of a week, 0·75 in weight, whilst the third dog, receiving four-times the weight of gelatine that it had of meat, even in a smaller proportion, remained in the same state. Thus there was no doubt that meat, even in small proportion, affords a nourishment which is vainly sought for in gelatine. But since, according to the opinion of some physiologists, it is necessary to add fat to the aliments of carnivorous animals, it was wished to ascertain whether, by adding it to galatine, the latter would be rendered more nutritive. The following result was obtained :—

	Dates.	Nourishment.	Weight.
2nd Dog	Feb. 17	Bread .. 0·125, Gelatine 1·000, Fat .... 0·062	7·50
	Feb. 25	*Idem*.....	7·00
3rd Dog	Feb. 17	Bread .. 0·125, Fat .... 0·062	6·75
	Feb. 25..	*Idem*	6·50

Consequently, the result was not more favorable than the others for gelatine; for the dog to which 1 kilogramme of gelatine had been given, over and above its ration of bread and fat, lost more than the dog which received only bread and fat. Finally, it was desired to ascertain whether, by adding gelatine to the ordinary allowance of the dogs described above, a more favorable result would be obtained. Consequently, there was given to one dog 1 kilogramme of this allowance with 0·750 of gelatine, and to another only 1 kilogramme of dogs' allowanee. The first gained, from the 27th of Feb. to the 6th of March, 0·50, the other 0·25. But we cannot place much confidence in this result, since the dogs, deranged by these continual changes of nourishment, became ill. It was, however, of too great interest to ascertain whether gelatine is valuable, for us not to hasten to make a new series of experiments. M. Westermann, member of the Council of Administration of the Zoological Garden, granted to the Commission two large dogs of the menagerie, one weighing 15, the other 17 kilogrammes. From the 16th to the 24th of March, they were nourished with 1 kilogramme of the said dogs' allowanee, and during this time they did not lose in weight ; so that it would appear to be a good ration for them. It was reduced to half, consequently to 0·50 of dogs' allowanee, and this diet was continued from the 24th of March to the 7th of April ; it was then proved that each dog had lost in weight, the first 1, the second 2 kilogrammes. Then it was asked whether gelatine could be substituted for the nourishment of which the dog had been deprived, and the following result was obtained :—

	Dates.	Nourishment.	Weight.
1st Dog	April 7..	Dogs' allowanee .... 0·500, Gelatine ..... 1·000	14 lbs.
	April 24 ...	*Idem*	12 ,,
2nd Dog	April 7 ...	Dogs' allowanee .... 0·500..	15 ,,
	April 24 ...	*Idem*.....	13 ,,

Each dog had therefore lost 2 kilogrammes, and the daily allowanee of 1 kilogramme of gelatine to the scanty ration of the dogs' allowanee appeared to have no effect.

The gelatine was then replaced by 0·500 of the ordinary food, which was also increased as much for the second dog. The result was—

	Dates.	Nourishment.	Weight.
1st Dog	April 24	.. Dogs' allowance 1 lb.	12 lbs.
	May 15	... *Idem*.....	13 ,,
2nd Dog	April 24	... Dogs' allowance 1 lb.	13 ,.
	May 5	..... *Idem*	14 ,,

Thus, in this space of time, a larger ration of dogs' allowance had the effect of increasing both dogs equally in weight. From the 5th to the 23d of May the same nourishment was continued, and the weight of the first dog increased 2 kilogrammes, and that of the second dog 1 killogramme; consequently, it was proved that the double quantity of gelatine was not sufficient for that which had been deducted from the dogs' allowance.

It will not be difficult to draw conclusions from these experiments; they are self-evident. Gelatine has no nutritive property when taken separately, and does not receive any if combined with other substances. It might be objected that the number of experiments is not sufficiently great for deducing this consequence; but the results are so positive and concordant, that the class thinks it may adopt the conclusion which may be drawn from it.

For that which relates to the proportion of gelatine in the soups called *economical*, which are distributed to the poor, regard should be paid as well to the almost imperceptible nutritive power of the gelatine which is extracted from bones, as to the small portion found in each soup. In the establishment at Utrecht, 100 kilogrammes of bones are exposed to steam for four days and nights. The gelatinous water which is extracted is sufficient for 4,800 portions of soup, each of which is equal to 1 lit. 25.* Consequently each litre of soup, contains the gelatinous substance of 0 kil. ·0167 of bones. However, the dry gelatinous substance which is acquired cannot be estimated at more than one-sixth of the weight of bones; thus we have 0 kil. ·0028 of solid substance in each litre, or 0 kil. ·0035—that is to say, 3 gr. ·5 in each portion of soup, which certainly makes a very small quantity. At Haarlem they employ 16 kilogrammes of bones per 1,000 portions of soup, each of which, consequently, contained not more than 0 kil. ·00266, or about 2 gr. ·5 of dry gelatinous substance.

It may easily be proved that it is nearly impossible to extract more than one-sixth of the weight of bones, in dry gelatinous substance, by operating on the large scale. The bones prepared for the operation contain rather more than one-fourth of their weight of water. The other three-fourths are composed, according to the analysis of Berzelius, of two-fourths of inorganic substance, and of one-fourth of organic substance, a small portion of which is insoluble in water. Finally, the bones can never be completely exhausted, but they always retain a small quantity of soluble organic matter. On account of all these losses, it will be necessary to reduce the fourth to one-sixth. The proportion of water was determined by an experiment in which 500 grammes of fragments of bones, sufficiently washed and dried, were exposed to a temperature varying from 167 to 221° F., so long as any diminution of weight could be detected; the loss of weight was 135 grammes. The same thing was also confirmed in another manner. Four kilogrammes of bones were treated in the steam apparatus, until the gelatinous fluid became aqueous, and furnished, after evaporation, only a very small quantity of gelatine. There was thence, in all, 6·56 of gelatine, which may be considered as containing, on the average, 0 kil. ·10 of dry gelatinous substance. For, since this gelatinous fluid was extracted twenty times during these fifty hours, and since it was evaporated to form a jelly, the average of gelatine produced in this time may be applied to it, since care was taken to give it always the same consistence, and since they had the habit of frequently determining the proportion of matter of the dry substance by drying. In the same manner was acquired from 1 kilogramme of bones, exposed five times, each time for eight hours, to steam in Papin's digester, 1 kil. ·282 of gelatine of equal consistence. Another time the action of water and steam was

* These 100 kilogrammes are contained in four cylinders; during an assiduous preparation of soup, one of these cylinders is emptied daily, in which these bones are kept during four days, and filled with fresh bones. 1,200 portions of bones are prepared every day. Such are, at least, the indications which one of the commissioners received, on his visit to the establishment at Utrecht. According to the pamphlet of M. Bergsma, the gelatinous substance of 100 kilogs. of bones would be distributed into 5,200 litres, instead of 6,000 litres. This difference is of too little consequence to modify the results which have just been mentioned. It is, perhaps, the consequence of a rather larger distribution of soups at the time of the commissioner's visit, than at the time the pamphlet was printed.

continued for a rather shorter time, and, from 1 kil. ·50 of bones, only 1 kil. ·614 of gelatine.

Thus it is sufficiently proved that the quantity of solid gelatinous substance is very small in each portion of the so-called economical soup, and consequently it cannot be denied that, even if they were found in it, the nutritive force would be lost entirely in such a mass of water: they give a nourishing and healthy aliment, not from the small quantity of gelatine found in them, but from the rice, peas, leguminæ, or potatoes which are added to them. Perhapsit might be concluded that their nourishing property might be increased by the addition of a greater quantity of gelatine; however, this would be wrong; for, according to the commissioners' experiments, it is sufficiently proved that, even in a larger dose, gelatine does not nourish, and that an insurmountable disgust arises if it is given alone. After that, it might be asked if it is useful to continue to employ gelatine in the soups of the poor, when it is sufficiently demonstrated that it has no nutritive power. It is evident that none but a negative answer can be given to this question. Truly, no danger to health need be feared from its employment. But why continue to extract it, in so expensive a manner, from bones? Why this useless waste of fuel? Would it not be better to replace these soups by another more nourishing diet? The Class does not consider itself called upon to explain itself concerning these questions, which belong to the Government; however, some of them have been answered by practical employment. In the Hospital of the German Israelites at Amsterdam, gelatine was used in the preparation of soups; experience proved that the patients were ill fed by it. Meat is now used, and two advantages are derived from its employment: that of being more nourishing to the patients, and that of being less expensive to the hospital. The Class flatters itself with having considered the question in every point of view, and with having satisfied the desire of your Excellency.

ON THE PARTIAL REDUCTION OF BINOXIDE OF COPPER BY HEAT; AND ON THE NEW OXIDE WHICH RESULTS FROM IT.*

BY MM. FAVRE AND MAUMENÉ.

It results from the experiments detailed in this memoir that binoxide of copper is decomposed at a temperature near that of the fusion of copper; it then fuses losing 8 per cent. of its oxygen, and is converted into a body which should be represented by the formula $Cu^5 O^3$. This new oxide may easily be distinguished, even by its physical properties, from the body which gave rise to it. Its surface presents a black color, because it absorbs oxygen in assuming the solid form; but its fracture is reddish, and when it is reduced to powder, it becomes almost as red as the protoxide of the same metal. It is hard and brittle.

The importance of the part which binoxide of copper performs in the laboratory, have induced MM. Favre and Maumené to make known the existence of this new oxide before completing the investigations which led them to discover it. In the mineral analyses in which it was customary to estimate the copper in the state of binoxide, perfectly concordant results were rarely obtained, because the commencement of decomposition by heat was seldom avoided. By acting on the new oxide $Cu^5 O^3$, obtained by the fusion of the binoxide, all uncertainty in this respect will be avoided.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE COMPOSITION OF FATS, AND THE THEORY OF THEIR CONVERSION INTO SOAP.

To the Editors of The Chemist.

GENTLEMEN,—

ALLOW me, through the medium of your Journal, to lay before your readers some new views relative to the composition of fats, and the theory of their conversion into soap.

They are stated with much diffidence, and under the conviction they will soon be either confirmed or proved fallacious. They are formed after careful observation of

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* *Comptes Rendus*, No. 15, April 8, 1844.

the phenomena of soap-making on a large scale, and will be stated here briefly, without any attempt at explanation or scientific accuracy; for whatever may be my pretensions to do so, I feel so much care is required and so much more time must be devoted to the subject than I can give, to work out the results in all their bearings, that it is best to leave their full development to more competent authorities.

The generally received opinion of the composition of oils and fats is that of M. Chevreul; indeed, it appears to me no subsequent inquirer has thought of challenging the base on which all his reasoning depends.

M. Chevreul asserts that fats and fixed oils always contain two, and generally three component parts, and that each of these bodies contains an organic base named "glycerine" or oxide of glycerule. This opinion arises from the belief that oxygen is one of the constituent parts of fats and oils; that they consist of carbon, hydrogen and oxygen. It is the presence of oxygen I dispute, and as a consequence the existence of an oxide of glycerule. I believe glycerine is a result of a particular mode of saponification, and this belief is founded on the following facts.

It is well known that different modes of soap-making produce, from exactly similar materials (fats), different quantities of soap, and more or less glycerine, varying from 7 to nearly 20 per cent.

These facts led to the consideration of how glycerine could be produced,, and I commenced various experiments on fats; and was soon led by one result to doubt the generally received opinion, that oxygen is one of their component parts. The result referred to is, that potassium and sodium will not decompose tallow as they do the fat acids; and that either the one or the other may be retained as perfectly, in pure, dry, fresh fat, as in naptha.

A great many experiments, with much observation, and finding the presence of water was necessary to the formation of fat acids, led to the conclusion that glycerine is produced during the formation of the fat acids by the decomposition of the water, the presence of which is required to form them.

I believe glycerine is not a base of fats; but that the hydrogen evolved from the water decomposed, unites with another portion of the fat and forms glycerine, and it is the peculiar circumstances, temperature, specific gravity, &c., of the materials used, and under which this decomposition takes place, that determines the quantity produced.

I have thus stated, as I promised, the result of my observations. I do not detail the numerous experiments I have made relating thereto. Whether right or wrong in these views of the manner in which glycerine is formed matters but little; that a greater or less quantity can be obtained, by various modes of soap-making, I am thoroughly satisfied; and this fact, I think, sufficiently disproves the opinion that it is the base of fats, oils, &c. I hope this slight notice will induce others, more able than myself, carefully to examine into the subject, and decide whether the views I have broached are, or are not, worthy of support.

The question is one of great importance, as, if I am correct, science cannot fail to discover some means by which the waste of from 8 to 20 per cent. of all the tallow, &c., used in the manufacture of soap may be prevented; a discovery which will amply reward the industry of whoever devotes his time and attention to the subject.

I am, Sir,

Your obedient servant,

W. H.

ON THE PRECIPITATION OF METALS BY OTHER METALS.*

BY M. BECQUEREL.

In the two foregoing memoirs I endeavored to explain the general principles by the aid of which we are enabled to deposit electrochemically the oxides on metals, in more or less thin layers, whence result colors analogous to those of the thin layers of Newton; I have likewise endeavored to solve all the technical questions which relate to them, in order that, immediately and without difficulty, industry may avail itself of this new mode of coloration; I have also given a very powerful varnish, by means of which the colors produced may be preserved from alteration, with the exception of the blue of the first and second orders. One single difficulty interfered, namely, that of the coloration of large surfaces of copper; but I have since ascertained that it is easily obviated, by using an apparatus of which the number of couples and the extent of the surfaces of each element are in proportion to the extent of the surfaces to be colored. From the time that I had arrived at the end which I had in view, I have been occupied with the solution of the same question with regard to the deposits of all metals on different metals, taking as a basis a general principle easily put in practice. That which has appeared to me the most convenient is

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* *Comptes Rendus*, No. 12.

immersion, at a high temperature, in a neutral solution of a double metallic and alkaline chloride, sometimes employing voltaïe action. In the memoir which I have the honor of presenting to the Academy are detailed the general results at which I have arrived, by examining the question only in a scientific point of view, intending to treat it at another time in an industrial point of view, because the applications require a number of investigations and minute details which long practice alone can acquire.

The precipitation of metals from their respective solution by other more oxidisable metals, has been turned to account for the wants of arts, from the most remote periods. The question is also of great importanec to general chemistry, whether the precipitated metal is found in the pulverulent state, or whether it adheres with more or less force to the precipitating metal. I am going to consider it in a general point of view, in order to endeavor to arrive at the causes which govern the precipitation of metals.

The relations which connect affinities with electrical forces are so well established, that it is possible, taking as a basis the data furnished by electro-chemistry, to create, in many cases, by means of the electrieal forces, affinities which, without them, would not be manifested. But before entering upon the subjeet, I will succinctly point out the use which the aneients made of metallic precipitates.

Gilding on metals has been known for many ages; the small statues and bronzes found in the tombs of Egypt are an evident proof of this. If, in other countries, less favored by climate, very few gilded statues are met with, it must be attributed to a more or less rapid alteration arising from the contact of the gold and bronze. At a much later period, in the Low Empire, iron or copper coins were struck covered with silver. According to Pliny, copper was gilded by means of mercury; copper was tinned and silvered in order to preserve it from alteration, an art, the discovery of which the eclebrated naturalist attributes to the Gauls, who made so much use of it, that the Bituriges silvered their chariots, litters, and other objects of daily employment. To silver copper, as may be conceived, was a simple operation; but it is not the same with iron, which requires a double operation. Vetruvius mentions the gilding of silver and copper by means of mercury. Zozimus, a profane writer of the fifth century, mentions the precipitation of copper on iron, an operation in which the copper appears with its metallie lustre. A thousand years after, Paracelsus informed us that, to decompose a solution of silver, it is sufficient to plunge into the solution a plate of copper, on which the metallic silver is deposited. Bernard de Palissy, in his Treatise on the Metals and on Alchemy, taught us that iron might be gilded and silvered, by plunging it in a very limpid solution with which he has not acquainted us: a plate of iron immediately took the appearance of gold and silver, according to the nature of the solution. Boyle afterwards mentions that, in order to gild iron by means of an amalgam of gold, this metal is first plunged into a warm solution of sulphate of copper; the copper precipitated serves for fixing the gold by means of mercury; finally, copper and brass were silvered by means of a chloride of silver.

Many other documents, which I do not here quote, prove that the metallic application for preserving oxidisable metals from atmospheric influences, or to give them the appearance of the precious metals, has been practised for ages; and it is even credible that the process by means of which iron and copper were immediately gilded, has been lost and found again.

Without entering into the historical examination of all that has been done relative to the application of metals on other metals since the establishment of modern chemistry, I will confine myself to saying that the intervention of electricity in this application constitutes a new era, in the establishment of which several men of science and manufactures have assisted. Among the former, M. de la Rive is distinguished; among the latter, Mr. Elkington, who discovered the property possessed by the solutions of alkaline aurates of gilding, at the boiling temperature, perfectly scoured copper objects plunged into them; he also found that the same solutions, and in general the alkaline solutions of gold, serve for electro-gilding with a simple apparatus. It was not until later that M. de Ruolz made use of these and analogous solutions, and gave extension not only to electro-gilding, but also to silvering and to the application of several metals on copper, iron, and even tin. This unexpected development given to the applications of the pile, rests, as is known, on the employment of alkaline solutions. It is, therefore, in these solutions that resides the dominant principle of the gilding and silvering with which industry is now occupied. It may, to a certain extent, be conceived from what the properties of alkaline solutions arise. When M. Payen observed that iron, steeped in solution of caustic potassa in a certain proportion, was preserved from all alteration, it was at first thought that this effect was due to the solution not containing sufficient air to

oxidise the metal. But this chemist having demonstrated that the preservative solution contained as much air as another in which iron was promptly oxidised, it must be concluded that the alkali exerted in this case an influence due to its contact with iron.

By examining the electrical effects produced in the contact of the solution and iron, it was ascertained that an excessively slow chemical action existed, of a peculiar nature, since both bodies took a charge of electricity only inasmuch as the circuit remained open for a few moments.

Potassa exerted, therefore, in its contact with iron, an unknown influence which prevented the iron from being oxidised at the expense of the oxygen contained in the solution.

By uniting this fact of the property of alkaline metallic solutions, serving, either for electro-chemical gilding, or for gilding by immersion, with this other fact that non-alkaline solutions cannot be used, in the same circumstances, for operating adherent deposits of gold, silver, or copper on different metals steeped in them, reacting less powerfully on the metals, permit the molecules to group themselves according to the laws of crystallisation, or, at least, in such a manner as to aggregate among themselves.

Such is the great advantage that is derived from alkaline solutions; but it must be owned that they do not always fulfil the desired object, as that of platinum for example, since it has hitherto been impossible to deposit on copper anything more than an excessively thin layer of this metal, without being able to make subsequent deposits adhere. It is for this reason that platinum has not yet been used in industry.

Such are the considerations which I have thought fit to present, before detailing the result of my investigations concerning the precipitation of metals from neutral solutions by other metals, with or without adherence, by employing or not the assistance of the chemical action of electricity.

ON THE PRECIPITATION FROM THEIR SOLUTIONS, BY MEANS OF ZINC, OF CERTAIN METALS HITHERTO CONSIDERED IRREDUCIBLE.

The principle by means of which certain metals in solution are immediately reduced to the metallic state, has long been known. It is sufficient to plunge into the solution a more oxidisable metal than that which is in combination. It is then substituted in its place in atomic proportion. It is thus that a solution of copper, gold, silver, &c., is decomposed with zinc, iron, &c. The deposit formed on the surface of the precipitating metal is sometimes pulverulent, sometimes more or less adherent, according to the density of the solution, the temperature, and different circumstances, among which stands in the first rank contact with the precipitating metal, from which results a voltaïc couple whose action is sometimes determining; we have an example of it in the turning of brass pins, which, steeped in a suitable bath of tin, are covered with a layer of the latter metal only inasmuch as they are put in contact with a piece of tin.

All the effects of this kind are due, partly to affinities, and partly to the electro-chemical effects which are the consequence of them. This concurrence of affinity and electricity should always be taken into consideration in investigations relative to the immediate reduction of metals.

The new facts which I now have the honor of communicating to the Academy, will prove the justness of my observations in this respect.

I will commence by giving, according to M. Thénard, a table of the reduction of saline solutions by metals.

Salts whose solutions are irreducible by metals.	Salts whose solutions are reducible by certain metals.*
Salts of the two first series.	Salts of tin
Salts of manganese	arsenic
zinc	antimony
iron	bismuth
cobalt	lead
nickel	copper †
chrome	tellurium
titanium	Nitrates of mercury—reduced by zinc, iron, and all before them; reduced by iron, zinc, and perhaps manganese.
uranium	Salts of silver ‡, palladium, rhodium, platinum, gold, osmium, iridium—reduced by iron, zinc, manganese, cobalt, and all those which precede silver.
cerium	

The precipitates noticed in this table are sometimes pulverulent, sometimes formed of more or less coherent parts; sometimes they adhere to the precipitating metal. The causes which produce these different molecular states

* In order for this reduction to be effectual, the new salt must be soluble.

† Acetate of copper is reduced by lead.

‡ Nitrate of silver is reduced by cobalt.

depend on various circumstances, some of which are known, and the others will be pointed out further on. The metals hitherto obtained in the state of black powder are antimony, arsenic, osmium, palladium, rhodium, and iridium; the others are formed of more or less aggregated parts, and possess mostly a metallic lustre—among others lead, mercury, copper, and silver. It will be seen how these metals may be obtained in very thin layers, with metallic appearances, by simple immersion in a metallic bath.

By glancing over the foregoing table, it is seen in the first column that the salts of manganese, zinc, iron, cobalt, nickel, chrome, titanium, uranium, and cerium, are regarded as irreducible by metals. Why has this conclusion been arrived at? It is because they were operated on, especially with respect to cobalt, nickel, and iron, in circumstances in which the reaction of the most oxidisable metal on the above-mentioned salts was too feeble for the reduction to be effected. It would, indeed, be the contrary, if the energy were augmented by means of heat. The following facts will furnish a proof of it, and at the same time will give to chemistry a new means of analysis, and perhaps to metallurgy and industry processes which may be of some utility to them.

To show how I have been led to the reduction in question, I will point out the relation existing between the electrical forces, by means of which we are enabled to decompose most of the above-mentioned salts, and the affinities by virtue of which the same decomposition is operated.

I demonstrated, several years ago, how, with the simple electro-chemical apparatus, in which the electricity was furnished, either by the oxidation of zinc alone or by the reaction on each other of two different solutions, separated by a diaphragm, all the salts might be decomposed, in such a manner as to obtain the metals in the metallic state, in crystals, lamellæ, or powder. Sufficient electricity might then be disengaged, by the simple oxidation of zinc, when converted into a current, to possess sufficient energy to operate the decomposition of metallic and the reduction of the oxides. Now, the least foreign bodies, metallic or not, provided that they be conductors adhering to the surface of the zinc, operate this conversion. It is the same when the zinc is not pure. Indeed, it has been demonstrated, that a piece of zinc of commerce, which contains several substances, is more attacked by the acids than that which is chemically pure. In the first case, it was ascertained, by means of a multiplier and two platinum points connected with this apparatus, which is passed *over* the surface of the zinc, steeped in acidulated water, that this surface is traversed in all directions by a multitude of electrical currents, which can take place only inasmuch as foreign bodies, alloys, or other conductors of electricity are found on the surface of the zinc. Such is the simple principle which has served as a point of departure in the investigations of which I now publish the results. Zinc should, therefore, be naturally the precipitating body, since it is the metal producing electricity *par excellence*.

What occurs when a piece of well-scoured zinc is plunged into a solution of a metallic salt at the ordinary temperature? This metal, whether it decomposes the salt or not, reacts before all on the water, and is oxidised at the expense of its oxygen, and the hydrogen becomes free. There results a disengagement of electricity, in consequence of which the metal takes the negative electricity and the liquid the positive electricity; but, by aid of particles of alloy, or other foreign conducting bodies, these two electricities constitute a current whose action renders the metal more oxidisable, or at least the parts not covered with foreign bodies, whence results a new energy in the oxidation, whilst the hydrogen aids in the reduction of the metallic oxides which are found in the solution: but if to this electro-chemical action, or rather to this multitude of electro-chemical actions, whose existence is demonstrated by means of platinum needles, be added the affinities of the oxygen or the acid, or bodies acting as such, more powerful for zinc than for the dissolved metal, and, besides the action of heat, which had hitherto been neglected, all the most favorable conditions for obtaining metallic deposits are then combined. With an increase of heat, the oxidation is more powerful, because the liquid becomes a better conductor of electricity, and because the current having more intensity, its decomposing action is augmented. It must never be lost sight of that the precipitation of metals, by means of a more oxidisable metal steeped in their solution, is partly a chemical and partly an electro-chemical phenomenon. I will also add that, even when there are no foreign bodies, alloys, &c., adhering to the surface of the precipitating metal, the latter in contact with water, acid, salt, metallic oxide, that is to say, oxygen and metal, we find all the conditions combined which can constitute effects of contact.

Such are the considerations which have led me to the reduction, by means of zinc, of several solutions, hitherto regarded as irreducible, as well as to the precipitation

with adherence of almost all non-alkaline metals on other metals.

(*To be continued.*)

EXPERIMENTS ON THE NUTRITIVE QUALITY OF THE CAKES OF SESAMUM SEED.*

BY MM. DE GASPARIN AND PAYEN.

Considerable interest, in an agricultural, manufacturing, and commercial point of view, attaches to the products of the seed of sesamum.

Perhaps the question, as economists now regard it, would be changed in aspect if we were to arrive at the certainty of being able, economically, to cultivate this rich oleaginous seed in our lands of Provence and Algiers.

Sesamum seed furnishes in abundance a sweet and almost colorless oil, adapted for various uses, and particularly for the manufacture of soaps. The extractors of oil, especially those who supply Marseilles, well know how to appreciate the advantages of the principal product of this first matter; but it is not known what are the properties of the residue of the powerful pressure to which the bruised seed is submitted. This residue, the cake of sesamum, would constitute, for rural economy, an important product, if it could be used for the nourishment of milch cows, and the fattening of animals, for it would increase the production of meat and milk, thus favoring the development of consumptions, still too limited among us, and leaving a greater quantity of manure at the disposal of our agriculturalists. But, in the first place, is the cake sesamum nutritious, and in what degree? Opinions are divided in this respect; and if, in recent esteemed works on agriculture, the question has been decided in the negative, it must be regretted that no experiment has heen quoted in support of this assertion. It has, therefore, appeared to us useful to endeavor to solve the question by special and direct experiments.

At our request, the Minister of Agriculture and Commerce has been kind enough to procure from Marseilles, and to place at our disposal, 220 kilogr. of sesamum cakes, from the oil manufactory of MM. Castinel and Co. Preliminary experiments have not enabled us to detect, in the products of the infusion and decoction of the cakes, any matter which could be poisonous in the quantities introduced into the alimentary regimen of animals; some little animals fully confirmed us in this opinion by their avidity and persistence to eat a piece of the cake which was found in their reach.

We thought, therefore, that we might undertake at once some experiments on alimentation, and proximate and elementary analyses of the samples which we had received.

M. Vinsson, a skilful cheese manufacturer, of Roquefort, at the Cour-Neuve, near St. Denis, consented to submit to the regimen of sesamum cake one of the sheep which he keeps for the purposes of his manufacture. He gave, gradually raising the doses, a quantity of the cake amounting to one-third of the total ordinary nourishment; the milk of this sheep, at the end of eight and fifteen days' alimentation with the sesamum, did not appear to him to be sensibly altered either in quantity or taste.

However, the necessity for keeping this sheep confined for several hours every day—the continual changes of nourishment taken by the flock in pasturage in fields not sown with corn, or on the borders of the roads; all these variable circumstances prevented us from being able to establish, experimentally, a precise comparison between the results of the two regimens; it was, therefore, in order to examine, on this occasion, the characters and composition of sheeps' milk, that we made the following experimemts.

The milk of the sheep fed with the cake was sensibly alkaline to test-paper; like the milk of the rest of the flock, the alkalinity was maintained during a portion of the concentration in the sand-bath; a neutral state succeeded to this reaction, and was followed by a third slightly acid reaction.

	1st Sheep	2d Sheep
100 cubic centimetres of milk gave a residue, which, dried at 212° F., weighed..	19·50	24·40
Containing whitish butyraceous matter ..	6·69	10·50

The residue of the evaporation, exhausted by ether of all its fatty matter, was analysed with the view of determining its nitrogen, and of deducing from it the weight of the caseïn and other nitrogenous substances. The following are the numbers of this analysis.

Substance employed ..	495 m. ·5
Volume of nitrogen ..	34 c.c. ·5
Pressure.....	0 m. ·763
Temperature.....	60° F.

Whence is deduced 8·13 per cent. of milk, dried and deprived of fatty substance. Admitting that the caseïn and nitrogenous matters of this milk contain 0·156 of nitrogen,

* *Comptes Rendus*, No. 18.

we should deduce from the analyses the following composition in the two conditions, which would indicate at least the approximative composition of sheeps' milk between two limits and in two different conditions.

SHEEP.

	Grazing at liberty.	Confined part of the day.
Water	75·60	79·50
Butter	10·50	6·70
Caseïn & other nitrogenous matter	7·54	6·92
Lactine, salts, &c.	6·36	5·88
	100·00	100·00 (?)

The milk arising from the whole flock, mixed, gave 18·66 per cent. of solid matter, or 18·1 after desiccation, *in vacuô*.

From these experiments it results that the milk of sheep is richer in solid substances than that of cows, in the proportion of 13 to 18 ; that, finally, its richness in butyraceous matter is relatively greater.*

With respect to the influence of the addition of the cake, it could be appreciated in the former experiment only with respect to the taste of the milk, and that appeared not to be modified.

We thought we might be able to combine more favorable conditions in a complete experiment, by addressing ourselves to the proprietor of one of the most considerable and best-directed establishments for the production of milk. M. Damoiseau, to whom we had already been indebted for his assistance and enlightened zeal for scientific applications, hastened to second our views ; and, whilst he, by degrees, disposed a cow in his stables for a regimen of which the cake of sesamum formed a large part, we determined the composition of the milk of the same cow, which produced a good quantity of milk under the influence of the ordinary regimen, and we obtained results very similar to those of the analysis formerly made of the products, which were always of good quality and sensibly uniform in this establishment.

It may be judged of by examining the comparative results indicated further on ; we will here first give the composition of the sesamum cake.

DETERMINATION OF THE NITROGEN.

Substance dried *in vacuô* at 212° F., 427 milligrammes.

Volume of carbonic acid gas, 27 c. c. ·5 ; pressure, 76 m.m. ·5 ; temperature, 65° F. ; from which is deduced, per cent. of dry matter, nitrogen, 7 m. m. ·47.

The hygroscopic water being 9·97, the normal cake contains 6·79 of nitrogen.

The dried substance furnished, by combustion, 0·2 of ash.

1 gr. ·378, treated by ether, gave 125 milligr., or 9·08 per cent.

These numbers lead to the following composition in the normal state :—

Nitrogenous substance	44·135	Nitrogen, 6·75
Non-nitrogenous organic matter	19·723	
Mineral substances	18·000	
Oil	8·172	
Water	9·970	
	100·000	

ANALYSIS OF COWS' MILK.

	Ordinary diet.	Fed with cake.
In 100 cubic centimetres of milk (dried in a sand-bath), dried substance	13·840	15·950
Butter extracted by ether	3·530	4·587

Thus, then, the milk obtained under the regimen of sesamum seed is more abundant in solid substances, and richer in butyraceous matter than the milk produced by the same cow fed with aliments of a quality long since recognised as suitable.

The observations transmitted to us by M. Damoiseau demonstrate, besides, that the new alimentation has been no less favorable to the production of milk, with regard to the total quantity.

The following is a comparative table of the two regimens, in one of which M. Damoiseau, replaced, by an equivalent addition of water, the water contained in beet-roots :—

NOURISHMENT OF A COW IN TWENTY-FOUR HOURS.

	Ordinary ration.	Regimen of the cake.
	KIL.	GR.
Beet-roots	32·000	—
Sesamum cake, broken	—	6·666
Water	—	26·667
White oat bran	2·667	2·667
Groats	2·667	2·667
Luzerne	4·000	—
Oat-straw	6·000	6·000
Common salt	0·650	0·650

Whence it is evident that 32 kilogrammes of beet-roots, and 4 kilogr. of luzerne, representing together 8 kil. ·5 of dried substance,

* The analysis published by MM. Stipian Lucius, and Bondt, would lead to the same conclusions, although these chemists found, in 0·25 of dry residue, only 0·058 of butter.

were replaced by 6 kil. ·667 of cakes, containing, indeed, a greater proportion of nitrogenous substance and fatty matter, and giving a more considerable product of milk not only with regard to its richness in cream and total solid matter, but also in bulk; for the milkings furnished in twenty-four hours:—

1. Under the influence of ordinary alimentation, 15 lit. ·5.

2. Under the influence of the regimen of sesamum, 17 litres. The flavor of the milk was also excellent.

Finally, it is right to add that the manual labor required for dividing the $6\frac{2}{3}$ kil. of cake with a hatchet, is evidently less than for cleaning and cutting in slices the 32 kil. of beet-root.

It, therefore, appears to us demonstrated that sesamum cake may be considered as a good aliment for milch cows, and, doubtless, for many other animals nourished or fattened in farms; if contrary results have been obtained, it may perhaps be attributed to the alteration in the cakes by mouldiness or the rancidity of their oil, especially if they have been kept too long and without proper care. We have, besides, had an opportunity of ascertaining that the cakes, tried, without success, for the nourishment of cows in M. Caffin's farm, were not exclusively formed of the products of sesamum seed, but were composed of the pressure of several oleaginous seeds.

It is known that cakes, properly employed in the nourishment of cows, increase the production of milk, and render its quality more butyraceous; but, in general, these residues communicate to the milk the peculiar taste of their oil; the cake of sesamum, whose oil, moreover, has no perceptible odor, would therefore be of more advantageous application in this respect, since it would increase the products without altering their agreeable taste.

ON THE MANUFACTURE OF SUGAR.*

BY M. DUMAS.

For a long time much has been said of a new and very remarkable improvement made in the manufacture of indigenous sugar, by M. Schuzenbach, and practised in some manufactories of the department of the North. I was desirous of making myself acquainted with the results which he had furnished. I therefore went, lately, to Valenciennes, where I could see the processes of M. Schuzenbach carried on on a large scale, at the establishment of MM. Harpignies, Blanquet and Co., who are always among the first to entertain improvements in our indigenous manufacture. Thanks to the details afforded me by these gentlemen, and to the confidence of M. Schuzenbach, who has been kind enough to place in my hands a completed and detailed description of his processes with the indications of the principles which have guided him, I have been enabled to form an opinion concerning the delicate questions which will necessarily be raised; and I have considered it my duty to submit them to the Academy, which contains judges at once best informed concerning these matters and in the best position for causing truth to prevail.

The following are the facts:—

M. Schuzenbach, by very accurate observations concerning the causes of the alteration which the solutions of sugar in water undergo, has been enabled to discover very simple processes which allow of the recovery, under the form of crystals, at least to nearly $\frac{1}{100}$th of all the crystallisable sugar which the solution contains.

Moreover, when this sugar is reproduced in crystals, it is sufficient, to render it colorless, to submit it to a systematic washing with solutions of sugar made without heat by means of apparatus invented by M. Schuzenbach; these washings are made with great facility, and, far from diminishing the proportion of sugar submitted to washing, increases considerably in weight.

Finally, by a solution and crystallisation then very easy, M. Schuzenbach converts into royal sugar the whole of this sugar thus purified.

It is thus that this skilful manufacturer is enabled to obtain from the variety of sugar which is called good-fourth *(bonne-quatrième)*, at least 80 per cent., and sometimes 90 per cent. of royal sugar. The members of the commission which was charged, some years ago, by the Minister of Commerce, with fixing the produce of sugars in refining, and our illustrious colleague, M. Thénard in particular, were, therefore, quite right when they maintained, against the assertion of our refiners, that, by working properly, at least 75 kilogrammes of refined sugar should be obtained from 100 kilogrammes of crude sugar.

These processes of refining have been put in practice in a very great number of refineries.

Again, M. Schuzenbach has ascertained that beet-root juice, when once brought to 30° of Beaumé, may furnish on the large scale, by his processes, exactly all the crystallisable sugar which can be extracted by the most careful chemical analysis.

* *Comptes Rendus*, No. 15.

These processes have been put in practice on a large scale in the manufactory of Tirlemont, in Belgium, and with some modifications which deficiency of apparatus rendered necessary in the manufactories of MM. Harpignies, Blanquet and Co., Harpignies, Delaunay, and Co., Leroi, Hamoir, &c.

Everwhere the success has been so much the more complete as the process devised by M. Schuzenbach has been more strictly adhered to, and as the state of the material has not been too much altered.

At Tirlemont, for example, where ten millions of pounds of beet-root have been operated on, about 5·5 of royal sugar have been extracted from 100 pounds of beet-root. It is estimated that, from unfavorable circumstances this year, a greater quantity could not have been extracted from crude sugar. Besides, the expenses of manufacture have remained the same as ever.

At M. Blanquet's manufactory this year, thirty thousand sugar-loaves, similar to those which I deposit with the Academy, have been produced. They have been brought to the state which is designated under the name of stamped sugar *(tapé)*, the weather not having permitted the necessary material to be organised, in forms of varnished iron plate.

The principles on which M. Schuzenbach founds his new method of extraction have, therefore, the result of rendering fully practicable that which we might have feared seeing remain long still in the domain of pure theory; for only two products now leave the manufactories which work according to these principles; viz., perfectly white loaf sugar, and molasses so exhausted as not to be able to serve for distillation. All the intermediate qualities have disappeared, and the produce, far from suffering, has sensibly increased.

These results have been obtained perfectly independent of the old process of drying beet-root, which M. Schuzenbach first practised on the large scale; but, according to the observations which his long experience has permitted him to make, this skilful manufacturer has ascertained that desiccation was successfully practicable only with beet-root grown on sandy, sterile, or not very productive soils, which furnish much smaller crops than the very rich lands of the department of the north, for example, but which give a root whose juice may be said to be only a solution of sugar very easy to be worked. These dried beet-roots are preserved without alteration.

It is not so with the beet-roots gathered in the parts of France which are more particularly devoted to this manufacture.

Moreover, M. Schuzenbach has placed at my disposal all the information relative to the method of working by dessiccation, which has been practised without interruption in a great number of manufactories in the north of Europe for some years, and which, for example, this very year, has been applied in a single manufactory in Hungary, to thirty million pounds of dry beet-roots, the same manfactory having also treated thirty millions of pounds of fresh beet-roots by the ordinary methods.

It is evident that the processes of M. Schuzenbach gives us the means of extracting, without any loss, all the sugar which is found in beet-root juice brought to 30° Baumé. If, then, we extract only from 5 to 6 per cent. of the weight of beet-root which really contains 8 or 10 per cent., it must be concluded that the preceding operations have destroyed or altered the portion of sugar which is not obtained.

The attention of chemists should, therefore, be entirely turned to the alterations which the beet-root undergoes at the time of rasping and by desiccation, and also to the means of preserving to the animal charcoal all its qualities, or to suppressing the employment of those which, on account of the impurities with which it is contaminated, might have serious inconveniences.

By means of some possible and easy improvements in this part of the work, the manufacture of beet-root sugar will be placed among the most perfect of chemical manufactures; for all that portion of the work which M. Schuzenbach has just handled, presents the model of a certain application of the principles of science to the practice of manufactories.

Now, we are forced to conclude from these new facts, that the legislation of sugar is very deficient; for, according to the basis of the estimation of qualities for the deduction of the duties on sugars, we are led to the distressing result of which I have lately been witness in one of the principal manufactories in the department of the North, where fine white sugar is made by M. Schuzenbach's process, and where it is afterwards piled up in order to mix with it 10 per cent. of molasses, in order to reduce it to the quality of good-fourth. If this operation were not performed, there would be a loss, on account of the exaggerated over-tax which would be required to be paid to the Treasury.

ON THE EXTRACTION OF BEET-ROOT SUGAR.*

BY M. PAYEN.

My position, as professor of applied chemistry, imposes on me the necessity of investigating, and of publicly discussing theoretical and practical questions concerning our great manufactures; every year, either at the central school, or at the Conservatory of Arts and Trades, I am obliged to make known the progress due to the active intelligence of our manufacturers.

If the opinion which I gave, this very year, concerning the present and future state of Home and Colonial sugar manufactories, seem to possess some value, it is because it embodies the opinion of skilful manufacturers, and because it has received their acquiescence. Besides, in publishing, on this subject, a very interesting communication in the last *Comptes Rendus*, M. Dumas raised the controversy concerning the important and delicate questions which his communication will cause to spring up; the Academy will, therefore, I hope, admit, that it is my duty to discuss them here.

I hasten to say that the ingenious observations of M. Schuzenbach, on the crystallisation, even when they might introduce a new idea in the clearing, and might constitute an invention, even when they might enable us to obtain as much white and pure sugar as is obtained from crude sugar, by known processes, which appears to me doubtful; these observations, I say, deduced, without doubt, from M. Thénard's opinion concerning the employment of saturated solutions of sugar, from the practice of clearing, and from the plan of the crystallisers of M. Crespel-Delisse, do not appear to me comparable to any of the great inventions introduced by French industry into the extraction of indigenous sugar, and into colonial manufacture—inventions to which are due, first, animal charcoal; second, black in grains; third, revivification; fourth, concentration with double effect *in vacuô*; fifth, the moulding of granulated sugars. I think I may appeal to M. Dumas himself.

With these inventions and their new improvements, with the processes of crystallisation and clearing, which are well-known, crystallised sugar may and ought to be obtained in the pure and white state. Such was, indeed, the conclusion of a report which I made on the process of M. Perraud, and the sugar obtained in loaves by this method should not, in any case, be mixed with 10 per cent. of molasses, as is the case with the sugar of M. Schuzenbach.

Thus, therefore, M. Schuzenbach does not appear to me to be able to claim the greatest share in the improvement of the extraction of sugar. Time will teach us if we may, with good reason, reclaim the honor of an useful and real invention; time which, especially in applications, often does justice to too sanguine hopes.

Three very remarkable examples here very naturally find a place. Ten whole years were occupied in very large experiments, in successive improvements, relative to the process of maceration, &c., bringing to the end of each country a firmer conviction in the mind of its celebrated inventor, concerning the advantages of a method capable of furnishing $\frac{95}{100}$ths of the juice of the beet-root; however, the reporters of the *Concours* of the central Societies of Agriculture and Encouragement, were still in doubt. Now doubt is no longer permitted, for this process, since last year, has disappeared from all the manufactories which had adopted it.

One of the most ingenious and best recommended apparatus, which, acting in a continuous manner, gave, without heat or pressure, by a simple, spontaneous, methodical washing, 90 per cent. of juice from the pulp, is abolished after having increased the expenses and diminished the products of the establishments which employed it.

Less time, but heavier sacrifices, developed the impracticability in France of the method of M. Schuzenbach, and which promised still more than his present system of crystallisation.

I might cite twenty other hardy conceptions, which, at least, their authors have applied at their own risk; but I have said sufficient to justify the reservation I have made, the recommendations which I have given, to wait prudently, if it were only to ascertain whether we do not already possess the equivalent of the invention presented.

In concluding, I beg the Academy to allow me to present here the conditions of success which I consider most important in the economical extraction of indigenous sugar:—

1. Adaptation of soil, cultivation and employment of pulps, diminishing by 12 or 13 francs the intrinsic value of 1,000 kilogrammes of juice.

2. Relaxation by one half of the speed of the mechanical pushers, and an increase in the number of rasps, in order better to divide the tissue of the beet-roots in the same time.

3. More gradual and more powerful pressure by increasing the number of hydraulic presses.

4. Employment of more considerable

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* *Comptes Rendus.*

quantities of black in grains, by aid of filters of three times the size.

5. The realised perfection of the apparatus by Degrand, Derosne and Cail, which enables us further to diminish the temperature of the evaporation by means of a more powerful vacuum.

6. Revivification of the black in grains by recently improved processes.

7. Preparation of crystals better suited for clearing, by employing the best processes in use or the modification added by M. Schuzenbach.

8. Methodical clearing in the cases of M. Schuzenbach, or, better still, in hoppers with false bottoms. The forms furnished with sand, or a sieve, or the filters of Dumont.

9. Moulding of perfectly purified crystals.

It will be readily understood that, by operating thus, only pure sugar, immediately applicable to consumption, would be sent away from the rural manufactories; that leaving, besides, for the nourishment of animals and the manuring of lands, the leaves, pulps, molasses, scums and deposits, the mass of the dung-hills, and the power of the soil would be increased.

Such results are well worthy the attention of the Legislature; they lead us to form, with M. Dumas, sincere wishes that the shackles which still retard the purification of sugars may totally disappear from our laws.

M. Dumas, without noticing the object of the remarks communicated to the Academy by M. Payen, confined himself to observing that the manufacturers of Valenciennes had anticipated him in all his wishes, for:—

1. Every one knows their skill as agriculturists and farmers.

2. They have long diminished by one-half the speed of rasping, by doubling the number of their rasps, which furnishes them much better divided pulps.

3. They press much better and with the addition of water, according to my advice, and they have obtained good results from this addition.

4. Their charcoal filters are now three metres in height, which appears difficult to be exceeded.

5. They employ the apparatus of Degraud, Derosne, and Cail, with all their improvements.

6. They revive their charcoal in newly-introduced furnaces, and which are supposed to be the best.

In a word, they have long practised that which M. Payen recommends to them as regards the operations which bring the juice of beet-roots to 30° of the areometer. I need say nothing of all these processes, which are well known, since it is at 30° that M. Schuzenbach takes the juice of beet-root, in order to submit it to his new system of crystallisation and clearing. This system is based on a scientific view, which appeared to me new. M. Payen's observations have not changed my conviction. I leave to M. Schuzenbach the task of proving that he has not bestowed on sugar manufacture a view so sterile as M. Payen supposes or fears.

Moreover, as M. Payen adopts, in his paragraphs 7, 8, and 9, M. Schuzenbach's method of working, rejecting his apparatus, the question thus limited would touch on private interests, to which I have all my life wished to remain a stranger.

At all events, and to conclude, the manufacturers of Valenciennes, whose manufactories I have visited, have done for six months that which M. Payen now recommends them. I add that M. Schuzenbach has introduced into the manufacture of sugar a scientific principle, which I regard as new, and which cannot be confounded with all the incomplete ideas which are compared with it.

M. Payen replied that his sole object was precisely to present a state, which M. Dumas himself acknowledges to be accurate and complete, of the great improvements invented by our manufacturers and constructors of apparatus—improvements much more important than the modification proposed by M. Schuzenbach, and which are not yet all introduced into the greater number of sugar manufactories.

IMPROVEMENTS IN THE MANUFACTURE OF SOAP.

BY EDMUND SNELL.

This invention consists in mixing with the saponified fats or oils, certain materials, prepared from potatoes and other vegetable matters containing farinaceous substances.

The method of preparing these materials from potatoes, is as follows:—The potatoes, after being washed, are reduced to a pulp, in any suitable apparatus, from which the pulp is allowed to fall upon two inclined sieves or screens, having a slight horizontal motion. At the top, and midway down the upper sieve (which is covered with wire-cloth of thirty meshes to the inch), are pipes, extending across the sieve, and perforated with numerous holes, from which water issues; the coarse parts of the potatoes are, by this means, separated from the finer parts, and discharged into a vat; while the finer parts pass through the upper sieve on to the lower one, (which has

sixty meshes to the inch,) where a further separation takes place, the coarse parts descending into the vat, and the finer parts, which the patentee calls *dextrine*, falling on to an inclined plane of wood, placed beneath the lower sieve, but inclined in the opposite direction. The dextrine is conducted by the inclined plane into a vat, where it is repeatedly washed in sieves of finer wire-cloth, until deprived of all its impurities; it then sinks to the bottom of the vat, and may be taken up in pails ready for use. The coarse part of the potatoes, termed *fibrine*, is washed in coarse sieves, and remains in a vat, covered with water, until it is wanted. If preferred, the dextrine may be dried, and kept until it is required for use; in this case, to each ton of saponified fat or oil, an addition is made of from 3 to 3½ cwt. of dextrine, which is first mixed with from 1 to 1½ cwt. of cold water, and, after standing for an hour, 6 cwt. of nearly boiling water are added; it is then mixed with the soap in the manner hereinafter mentioned.

White soap is made by the patentee from tallow or oil and alkali, in a boiler heated by a steam jacket, using as much alkali as the tallow or oil will take up; and when the soap is in a fit state "to cleanse into a frame," he takes, for each ton of saponified matter, from 4½ to 5 cwt. of dextrine, in its wet state, and adds thereto about 6 cwt. of boiling water so as to make it into a thin paste. This paste, as soon as all the spent lye is pumped out of the boiler, is added to the soap, and, when properly mixed and heated, the soap may be cleansed into frames, in the usual way. Yellow soap is made in a common soap pan, with tallow or oil and alkali, and either with or without resin; after the soap is "fitted," it is heated in the boiler before mentioned, and the above quantity of dextrine is added, in the manner described. If no resin is put in the soap, a much larger quantity of dextrine may be used; and it may be added either with or without "fitting" the soap.

When fibrine is used in the manufacture of common soap, as much water is taken from it as will leave a thick body, which is then put into a boiler, heated by steam, together with an equal quantity of tallow or oil and resin; alkali is added in the usual way, and the whole is boiled until it is ready to be cleansed into frames.

Common soap, made in the ordinary manner, and containing a large quantity of alkali, may be re-melted, and dextrine added thereto, for the purpose of improving its color, and preventing it from wasting so fast in hot water as it would otherwise do.

In concluding the description of this invention, the patentee says, "What I claim as my invention is—First, the mode of manufacturing soap by combining therein the vegetable matters which I have called *dextrine* and *fibrine*, by mixing the same with saponified fats or oils, as herein described; and, Secondly, I claim the obtaining *dextrine* and *fibrine*, to be used in the manufacture of soap, by means of the sieves, as herein described."

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, ETC.

THE PHARMACEUTICAL SOCIETY.

To the Editors of The Chemist.

GENTLEMEN,—

THE readers of the "Transactions of the Pharmaceutical Society of Great Britain" will not unfrequently find among the notices to correspondents passages such as this—"——and——enclose hand-bills issued by Chemists which reflect no credit on the parties." Wherever it is possible (and this, alas! is but seldom the case), there is very carefully added to the end of the paragraph—"The parties are not members of the Society."

Now, how numerous are the presentations of curious and amusing shop-bills which the Editor of the above Transactions does receive it is impossible to estimate; but I should think they must be manifold. I have knowledge of many being sent, which, perhaps, from pressure of editorial engagements, perhaps from more prudential motives, have not even received the attention of an acknowledgment among the answers to correspondents.

Not long since, I forwarded to the Editor some specimens which I thought would be amusing to the readers of the Pharmaceutical Transactions, and would at the same time exemplify to the Council the way in which the initials of the Society were perverted. As it has not been deemed convenient to print them in the Magazine to which I conceive they of good right belong (being the effusions of one of its proprietors), I now forward you copies thereof.

Some few months back, I was travelling

through a town situate a short distance north of London, and had occasion to go into a shop wherein was displayed, just in front of the door-way, and about four feet within the shop, the diploma of the Pharmaceutical Society, handsomely framed, glazed, and elevated on a stand, enough to convince the "uninitiated" that they stood in the presence of a "Royal Arch" Chemist whenever they stood before the head of that emporium. From this establishment I obtained the following poem :—

"If drugs you would have of the very best sort,
Go to ——'s, the Chemist, where they may be bought,
And fine patent medicines for woman or man,
Horse, cattle, and pig drinks the best that you can ;
Genuine sheep ointment the strongest that's made,
In preparing of which ——— can challenge the trade.
If tea you would have of the finest in kind,
The price and the palate he'll suit to your mind :
He's fine Turkey coffee the best in the mart,
To warm both the stomach and gladden the heart :
If wines are your object, both strong, good, and old,
His is the shop where the purest are sold ;
They'll cheer up the spirits and be a reliever
From cholera morbus or typhus fever.
His segars and snuffs are the rarest indeed,
And as for tobacco the pure foreign weed.
If spices, vinegar, or pickles you'd buy,
Just step into ——'s, have a little, and try
Figs, oranges, lemons, or sugar-candy,
Barley-sugar, and most sweets that are handy,
Lozenges, nuts, muscatels, almonds, and prune
Fifes, flutes, and violins for playing your tunes.
If such you may want the best you can get,
As none are sold better in ——shire yet.
The young and the old may be suited to taste,
With fish-sauces, capers, or anchovy paste ;
Also tooth, clothes, nail, plate, hair brushes, and oil,
Perfumery, hair pins, and combs free from soil.
Jewellery cheaper by twenty per cent.
Than many could buy if to London they went.
Stationery in all its various branches,
Engraving performed as fashion advances.
A large stock of snuff-boxes, rich, good, and rare,
And Rowland's maccassar for oiling the hair.
Fancy soaps of all sorts for beauty and smell,
Cold cream for the hands and face—lip-salve as well.
His paints, oils, and colors the richest in shade,
And as to quality the best that are made.
Ready money, remember, kills flying, they cry,
The which you must pay for whatever you buy."

I presume the best course is to offer no opinion on this, but to lay it before your readers as a sample of one of the *elements* of which that great compound body called the Pharmaceutical Society is composed.

The next bill which I obtained from this gentleman's establishment was concerning some pills which he prepares, and which he calls "Odd Fellow Pills." I have not one of these specimens by me now, or I would send it to you ; however, I shall be passing through this lucky town again shortly, and I will then obtain one, and forward it to you. To this the proprietor signs his name, and adds *all* the following initials :—M.P.S.G.B., and M.I.O.O.F.M.U. Now, do not be envious because you cannot write so many letters after your own names, I will tell you how to obtain this privilege ; pay two guineas a year to the Pharmaceutical Society, that gives you the M.P.S.G.B., then join the Odd Fellows Society, and that gives you the M.I.O.O F.M.U., which seven letters mean, Member of the Independent Order of Odd Fellows of the Manchester Unity. Do not be so profane as to suppose that these initials are of no use ; don't they sadly puzzle the uninitiated, and don't they look vastly as though the man to whom they belong has passed through much laborious study, and been "tried and approved" by learned examiners. Then observe what weight it gives to your name should you be required to give a certificate to any of your friends or neighbors, no matter what you are required to certify to, you must be suppposed to understand it ; a man's knowledge must be very little short of universal to entitle him to so many letters attached to his name, all marking a high state of knowledge in some of the scienees. Do you doubt this ?—then take an example :—

"——— ACADEMY.

"BOARDING, WEEKLY, AND DAY SCHOOL,

"CONDUCTED BY THE MISSES ———,

"WHO return their most sincere gratitude to their friends that have given to them their confidence and support for so lengthened a period of years, and beg most respectfully to announce that they have changed their residence to more enlarged, healthy, and capacious premises, and consequently have no hesitation in saying that, by their indefatigable exertions, united with a healthy spot, in one of the most healthy towns in the kingdom, parents who value the progress of intellectual and mental faculty of their offspring, with indulgence and every attention combined, cannot hesitate their qualifications, when the following respectable certificates are given :—

"TESTIMONIALS.

"To the Misses ———.

"LADIES—I have every reason to be satisfied as regards your capacity for educational qualifications of children in French, drawing, needle-work, and pure English grammatical pronunciation, as also good moral discipline, from vigilant inspection of your tuition of two children of mine, who have been pupils, one from the age of two years up to the age of twelve, and who still continues with you, and that she there first learnt her alphabet, rudiments in music, drawing, &c. &c. &c., which you ladies have proved yourselves competent to give, and beg to subscribe, yours, thankfully,

"———, Chemist, M.P.S.G.B.

"We, the undersigned, feel equally satisfied with the educational talents of the Misses ———, as Mr. ——— does."

After this, you can no longer doubt that the august M.P.S.G.B. may be made serviceable to the interests of your friends and neighbors ; and as a last (a parting) gift, I enclose you a specimen of this pharmacentist's shop-bills, wherein Scripture, classic literature, the writings of divines and poets, are all brought before the reader *to recommend a pill*. Gentlemen, what think you of th society to which this chemist, grocer, wine-merchant, pigs' feet dealer (for a dish of pigs' feet stood on his counter for sale)—this

jeweller, fiddle seller, &c. &c., pays his two guineas annually, under a fear that if he and many others did not so pay, the strong arm of the law would interfere—aye, and justly and properly interfere, to prevent such persons from adding to their other manifold engagements that of practising as apothecaries. Oh! a little pure chemistry is far more delightful than a great deal of quackery, but 'tis less profitable. Yours, &c.,

NEMO.

THE PHARMACEUTICAL SOCIETY.

To the Editors of The Chemist.

GENTLEMEN,—

IF you will refer to the Pharmaceutical Transactions published on the 1st of June, you will find that some persons have made the very reasonable inquiry, "When does the Council intend to apply to Parliament for a bill to protect qualified Chemists and Druggists?" The answer given is concise—"*As soon as the proper time arrives.*" In reading, it is sometimes the case that a particular sentence makes such a strong impression on the mind, that we find it pressing itself upon our notice at times and in places when and where we did not expect it. This same sentence, "as soon as the proper time arrives," had this peculiar effect on me, and I found myself frequently wondering when this proper time was likely to come; and this has induced me to look more closely into the progress and present financial position of the Pharmaceutical Society, and to reckon how much the druggists of this country have paid for their cap and bells. It will, perhaps, be as well for me to confess myself a country druggist, living in a small market-town, and that I have paid four annual subscriptions to the Pharmaceutical Society, amounting to eight guineas; the young gentlemen in my shop have also contributed other six guineas. If I were asked why I have contributed these eight guineas, and countenanced the paying of the other six, I should first impress upon the person asking such question, that I did not pay it or join the Pharmaceutieal Society from any fear of Mr. Hawes's Medical Reform Bill; neither do I continue to pay two guineas a year for the purpose of assisting in "uniting the chemists and druggists into one ostensible, recognised, and independent body, for protecting their general interests," if by their general interests be meant the perpetuation of their encroachment on the province of the regularly-educated medical practitioner, and their dabbling in a science for which they are not qualified; but I have hitherto paid my two guineas per annum with the hope and expectation of seeing it applied to "the advancement of Pharmacy, by furnishing an uniform system of education;" and as this was one of the avowed objects for which the Society was formed, it is surely not premature, in the fourth year of its existence, to inquire how far there is expectation of this object being accomplished? The *Journal* says, "as soon as the proper time arrives." This, of course, implies that the proper time has not yet "arrived." Well, then, in the fourth year of its existence, after having received (if we estimate the present year's income by the last) over 20,000*l.*, what is the Society effecting in the way of furnishing this "uniform system of education?" Can you, gentlemen, answer this question? Is not the proper time come, when 20,000*l.* have been subscribed, and when between 8,000*l.* and 9,000*l.* of those subscriptions are quietly placed aside in the Funds? Is it sufficient for the wants of our profession that a course, or that courses of lectures are given? I admit the high talent of most of the gentlemen who deliver those lectures; but if Liebig, Faraday, Graham, Brande, and all the others whose names are famous in the science, stood in the Society's rooms daily, and lectured without ceasing, they would fail to teach chemistry, unless they combined practice with their theory. But, to shift my position from general to particulars. A short time since a young gentleman, who had completed his term of apprenticeship with me, went to London with a view of carrying forward his chemical education; he had been a subscriber to the Pharmaceutical Society from the first; he had carefully read and studied all its printed "Transactions;" he had had the advantage of a good library of chemical works, and almost every English periodical devoted to the science; he had had time and opportunities offered him for study, and he had taken advantage of these. I am one of those who subscribe to the opinion expressed by Mr. Bullock in his lecture, reported in your last, that "*the man who prepares a prescription ought to be capable of making an analysis.*" Now, had the Pharmaceutical Society established a school of chemistry, and employed in it well qualified men—and there are many such to be found—gentlemen, the chief business of whose lives has been to gather knowledge, and impart it to others in the most useful method; had there existed the means of this young man employing the whole of the day in the study and practice of chemistry on the Society's premises, he would undoubtedly

have enrolled himself among the number of students. As it is, he contributes towards its yearly income, pays towards and attends its lectures, and is obliged to study practical chemistry elsewhere. Do you think this a solitary instance? Would not every chemist, druggist, or pharmaceutist (by whatever name you like, for chemists are scarce, though druggists are manifold), be glad to have some authorised school or college to which his pupils could repair for the completion of their education, where they could be instructed at a somewhat less cost than they are now obliged to incur, as private pupils, in the laboratory of some professor, at a cost of 100*l.* or 150*l.* per annum? But, perhaps, the *proper* time has not yet arrived.

In the year 1842, a very excellent letter was published by Dr. Gregory, Professor of Chemistry at Aberdeen, addressed to the Earl of Aberdeen, "On the state of the Schools of Chemistry in the United Kingdom;" this letter has, doubtless, been read by most of your subscribers; and I would take the liberty of recommending it to the careful perusal of every subscriber to the Pharmaceutical Society. The Professor, in the commencement of this letter, sets forth, in a very striking and lively manner, the importance of our science;* expresses his regret at the imperfection of the schools of chemistry in this country, and points attention to the school in the University of Giessen, built and furnished under the superintendence of Professor Liebig. On the point of expenses, Dr. Gregory remarks, "The absolutely necessary expenses of a laboratory may be classed under three heads—

"1. The original outlay in building and furnishing the laboratory.

"2. The annual outlay for materials, and for the wear and tear of apparatus, and for fuel.

"3. The salaries of an assistant and servant, &c."

We find in this letter that the cost of building the laboratory, including all furnaces, sand-baths, water-pipes, and the numerous indispensable fixtures, was about 1,120*l.*, and it is accommodating fifty practical students. The annual expense, when the pupils did not exceed fifteen, was 130*l.*, or at the rate of 8*l.* 13s. 4d. per pupil.

The salaries of an assistant and servant are paid by the Government, as are most of the other expenses. The Professor has a handsome salary, and a free house. The fees paid by working pupils are calculated according to the number of days per week employed in the laboratory. Those who work one day per week during the course pay about 1*l.* 2s.—for every additional day the charge is the same; but most of the students work six days per week, and pay about 6*l.* 14s. for the course, the length of which is from eight to nine months.

From these extracts it appears—

1st. That a laboratory, capable of accomodating 50 pupils, can be built and furnished for about 1,200*l.* 2nd. That the expenses of maintaining the laboratory is about 9*l.* for each pupil studying therein.

Then, as the Government of this country is not at all likely to furnish funds for the support of a chemical school, we must look entirely to the students. Suppose, then, that to the cost of maintaining the laboratory were added such a further sum as would be deemed sufficient to pay the salaries of professor, assistants, servants, &c., and this further sum charged on the pupils; for instance, add another 15*l.* to the 9*l.*, making 24*l.* for the eight months' course of practical chemistry; of this 15*l.*, one-third might be devoted to the professor as his salary, and the other two-thirds divided among his assistants and servants.

In the year 1843, there were upwards of 3,600 subscribers to the Pharmaceutical Society: supposing, for illustration, that this was the outside number of persons who could be compelled to qualify themselves for the practice of pharmacy, then, as we may calculate that the average duration of these persons will not exceed 40 years, it will show 90 students always under tuition, even if none study more than one season.

But would it be wise to leave it to the choice of young men (or to their parents) whether they should study practical chemistry under experienced professors, or set themselves down as vendors of drugs without having obtained the necessary qualifications? Surely not; the education should be compulsory, and a parent, when placing his son in this business should know that it involved the expense of the young man studying at the authorised and acknowledged school. But perhaps it is the intention of the Council of the Pharmaceutical Society to do something better than all this "when the proper time arrives." Well, then, when will this important time arrive? What delays it? Are not four years sufficient to digest and mature plans? Is not a capital of 8,000*l.* and nearly 4,000 subscribing members sufficient to inspire the timid Council with enough confidence to apply to Parliament? If these things are not enough, can you, gentlemen,

* Much that is pleasing and instructive will also be found by your young readers in Professor Liebig's *Familiar Letters on Chemistry*. 1844.

tell me what they wait for? I trust they will no longer delay, but awake, arise, and show that they are earnest for the extension of a knowledge of practical chemistry. If they delay longer, will not their country brethren have cause to suspect that it is love of their present power and position, and fear of losing this power; and clearly foreseeing that a school of chemistry once established by law would swallow up all necessity for the present Pharmaceutical Society, that keeps them from the good work. If they longer delay, all those who now entertain an erroneous impression of the powers and privileges conferred on the Society by the charter (the *costly* charter), and all those who have hitherto entertained fears lest legislative enactments should be retrospective, will have come to right conclusions on these points, and, fear no longer influencing their judgments, they will withdraw their subscriptions.

As I have now trespassed at great length on your space, I will for the present close my remarks with some extracts from the financial reports of the Society.

In the first year, 1841, the income of the Society was 1,944*l.* 11s., and was derived from 934 subscriptions, some donations, &c. &c. The expenditure was 279*l.* 16s. 3d.

The first three months of the year 1842, the Society's income was 3,220*l.* 18s. 2d. and derived from 1,960 subscriptions, premium on exchequer bills, donations, &c. &c.

The expenditure for these three months was 867*l.* 18s. 4d.; at this period of the Society's affairs, we find 2,991*l.* 5s. invested in the public funds; also 871*l.* 3s. 3d. transferred from the Druggists' Association Fund of 1815.

The Pharmaceutical Transactions in 1841, cost 50*l.* per number; there were then 934 subscribers.

They also cost 50*l.* per number in the first three months of 1842, when there were 1,000 more subscribers.

The income of the Society from 1st of May, to 31st of December, 1842, amounted to 3,149*l.* 2s. 8d., and was derived from 2,029 subscriptions, donations, entrance fees, registrations, interest on stock, &c. &c.

The total number of subscribers this year was 3,971, and the gross income 6,369*l.* 10d.; for the last eight months of the year the *Journal* cost 1,078, or nearly 135*l.* per month, or about 5s. 6d. for each subscriber for the eight months.

Out of this eight months' income there was invested in the public funds the sum of 1,838*l.* 2s.; the amount paid away for rent and rates was 224*l.* 9s. 9d. The expenses of the lectures exceeded the amount of receipts from pupils by 10s. 4d.

In the year 1843, the receipts of the Society amounted to 6,438*l.* 1s. 5d., and was derived from 3,634 subscribers, together with donations, interest, fees of admission to lectures, registrations, &c. &c.

Out of this, 2,445*l.* 3s. 7d. was invested in the public funds. This year there is a falling off of 325 subscribers, 23 of whom were members, and 302 associates; there is an addition of 5 life members; the total number connected with the Society was 3,651. The *Journal* cost with its delivery 1,293*l.* 1s. 2d., or a trifle above 7s. for each subscriber; the school of pharmacy, which, I suppose, means the lecturer's fees, cost 577*l.* 14s.; the receipts from pupils who attended those lectures, 207*l.* 7s. 6d.; loss, 370*l.* 7s. 6d. The charter cost 667*l.* 19s. *Travelling expenses* of county members of Council, 20*l.* 15s. 6d.; rent, rates, &c., 355*l.* 10s. 5d.; advances to branch schools in the country, 221*l.* 10s.; and the account closes with the treasurer having advanced 1,351 15s. 11d. for the use of the Society, which of course has been paid out of this year's subscriptions, and we shall know all about next June.

In the foregoing I have written nothing but what I have gathered from the printed reports of the Society; if, in any point, I am in error, it has not been intentional, but proceeds from not clearly understanding the statements printed. I think I am substantially correct in all I have advanced; and now, gentlemen, when will the proper time arrive for establishing "an uniform system of education?"

I am, gentlemen,
Respectfully yours, &c.,
A Country Druggist.

ON PIX ABIETINA, VEL BURGUNDICA—TRUE AND FACTITIOUS.

BY A. J. COOLEY.

The resin of the Pinus Abies, obtained by making incisions through the bark, when purified by subsequent melting, and straining through coarse bagging or cloths, forms the *true* Burgundy pitch of the British Pharmacopœias (Pix Abietina, Lond; Pix Burgundica, Edin. and Dubl.) The process of purification, &c., is carried on shortly after the period of its collection, which takes place principally in the neighborhood of Neufchatel, from whence it is brought in casks and other packages, and may be obtained in this country at a very reasonable price.

For many years, however, the importation of this article has been gradually lessening,

and, at the present time, the greater portion of the Pix Burgundica consumed in England is a compound, formed principally of the resin of the Pinus Sylvestris, P. Australis, P. Tœda, P. Maritima, &c., popularly known under the name of yellow resin. The latter article, or factitious Burgundy pitch, commonly known among manufacturing druggists as British pitch, or common Burgundy pitch, though frequently possessing a livelier color, is deficient in many of the properties and qualities of the imported article. The genuine Burgundy pitch possesses an agreeable aromatic terebinthinate odor, a warm resinous taste, and an opaque yellowish-brown, or reddish-brown color. It rapidly softens when held in the hand, and displays considerable unctuousness and tenacity, at the same time that it admits of being easily broken by a smart blow. The mass of the factitious pitch, on the contrary, is of a livelier color, and more friable, has a nauseously-resinous taste, and is wholly deficient in that aromatic odor and that peculiar toughness which have been just mentioned. The physiological action of the two articles is also considerably different. True Burgundy pitch acts upon the skin as a powerful local stimulant, exciting a slight degree of inflammation, and not unfrequently producing a pimply eruption, and an exudation of purulent matter from the cuticle on which it is applied. It is celebrated for its effects when employed as a plaster, in all cases where warmth, support, and long adhesion to the skin are desirable, and in the latter quality, perhaps, no substance equals it. I have worn a plaster of pure Burgundy pitch over my chest from the month of November to the following April, and still sufficient adhesiveness has remained to keep it in its place. The factitious Burgundy pitch possesses similar properties, but in an immensely less degree, and it appears wonderful that the trifling difference in price between the two should have been the means of banishing the genuine article from the shops of the larger portion of the retail druggists.

The method of producing a beautiful article of factitious pitch, much superior to that usually met with in trade, is to melt 1 cwt. of good yellow resin, and when it is liquid to withdraw the heat, and add one gallon of clear linseed oil, and a sufficient quantity of palm oil or annotto to impart a proper color. The mass is then to be well stirred together with a large wooden spatula, and either allowed to cool sufficiently by standing, or by working it with cold water, when it is taken out and pulled through the hands repeatedly (in the same way as emplastrum plumbi is treated), and then placed in bladders or stands for use. The palm oil ought to be of the finest quality and color, as if the latter (especially) be deficient, so much will be required to produce the necessary tint, that it will render the article rather too soft. But this is easily known by a previous trial on a small scale, for, by adding the palm oil previously to the linseed oil, the latter being then added gradually, and the mixture submitted to occasional trials, by cooling a small portion, the object to be aimed at is to produce an article sufficiently firm to resist the heat of summer, without becoming too brittle when exposed to the cold of winter.

When annotto is employed, the color is more brilliant and durable, but its use requires more management. It should be boiled in a separate vessel with a little water, until the whole is mixed, when a little of the melted resin should be added, and the boiling again continued for a short time. The mixture may then be poured into the other ingredients melted together, and the whole must be then well mixed up. When this coloring is employed instead of palm oil, more linseed oil may be used; but, as before mentioned, the quantity of this article necessarily will depend on circumstances, easily ascertained by a person of any experience. The addition of a little of the "droppings" or "bottoms" of Canada balsam, Ohio turpentine, oil of juniper, &c., will vastly improve this article, and render it equal to foreign pitch; but in commerce this is never attempted, the great aim being a MODERATELY LIVELY COLOR.

The manufacture of this article is equally successful on the small as on the large scale; a single pound may be made quite as well and easily as a ton.

A common melting-pan and fire (if clean and carefully managed) will succeed sufficiently; but, of course, both for safety and convenience, steam is preferable, and, on the large scale, almost indispensable.

A good workman will pull and put in stands or casks about 5 cwt. daily, or from 1 cwt. to 3 cwt. in bladders, the latter quantity depending on the size of the bladder; the small bladders occupying much longer, from the greater loss of time in tying, cutting, &c.

POISONING BY EUPHORBIA LATHYRIS.

BY M. JACOB.

SOME time ago the sieur, proprietor in our neighbourhood, was suddenly seized with

violent vomiting, and sanguinolent alvine dejections, which brought on death at the end of three days. The authorities, suspecting the circumstances accompanying this death, that poisoning had taken place, ordered a chemical analysis of the body.

Being charged, conjointly with Dr. Lemoine, of our town, by virtue of an order of M. Retif, Judge of Instruction to the Tribunal of First Instance, of Tonnerre, to proceed to this analysis, we devoted ourselves to a series of experiments, in order to arrive at the detection of the poison. These experiments having been with us the subject of several important observations, and, thinking that they might not be uninteresting to those of my brethren who are engaged in medico-legal analyses, I have thought it my duty to communicate to you the principal results.

In the first place I shall observe to you, that no physician was called in during the first two days of Severg's illness; that, during all this time, the vomitted matters were carefully thrown away by the persons who were interested in removing them; that the physician himself, who was called in on the third day, not suspecting poisoning, had not collected these matters; that, finally, after the most careful investigations have been made, the authorities having discovered at Severg's house only some inactive plants, we had no indications to guide in the direction to be given to our researches.

1st. Was the death occasioned by the action of a poison?

2nd. If so, was this poison organic or inorganic?

3rd. Were the various vegetable substances found at Severg's house, and on his dunghill, poisonous, and could we found on them alone the act of an accusation of poisoning?

Such were, if we have rightly appreciated the serious mission which we had accepted, the three questions which we had to solve, the three delicate problems on which we were called to decide, and whose solution required the numerous experiments of which I now give you the result.

The attentive examination of the interior of the stomach and large intestines of Sieur G. not having led us to any satisfactory result concerning the nature of the poison which we had to seek; not knowing, consequently, which way to direct our investigations, we began by submitting to a prolonged decoction, in a close vessel, a portion of the liver, a kidney, and half of the stomach and large intestines. The liquid arising from this long decoction, separated from the fat by cooling and decantation, was of a deep yellow, opalescent, and powerfully reddened litmus. This liquor, concentrated at a gentle heat, was divided into several portions, in order to be submitted to the following various experiments.

INVESTIGATION OF A CUPREOUS POISON.

Treated by ferrocyanuret of potassium, arsenite of potassa, hydrosulphuric acid, ammonia, and a well cleaned iron plate, this liquor gave none of the reactions of the salts of copper.

INVESTIGATION OF A MERCURIAL POISON.

Lime-water, iodide of potassium, the small pill of Dr. James Smithson, the evaporation of a small portion of the liquid, and the calcination of the residue in a little glass tube, did not detect the presence of a mercurial salt in this liquid; it was the same with the salts of lead, ammonia, &c., the reagents did not detect the presence of any of these poisons.

INVESTIGATION OF AN ARSENICAL POISON.

Among the mineral substances, it remained to ascertain whether it was this very active poison, so easily procured, and so frequently employed in crime.

We should first mention that the color of the precipitates, furnished by reagents employed for dissolving this metal, led us, at first, to fear having to pronounce on poisoning by arsenic. Thus, we paid particular attention to the detection of this poison.

The part of the liquid arising from the decoction of the organs already mentioned, under the influence of a test for arsenic, gave the following precipitations:—

RE-AGENTS EMPLOYED.	PRECIPITATES OBTAINED.
Hydrosulphuric acid and some drops of hydrochloric acid.	Very scanty yellow precipitate, manifested only at the end of ten minutes, and totally deposited in half an hour. This precipitate was not sensibly soluble in water.
Lime water.	An almost instantaneous white precipitate, soluble in nitric acid, producing a slight motion in the liquor.
Nitrate of silver.	A very abundant yellow precipitate, partially soluble in ammonia.
Ammoniacal sulphate of copper.	Green coloration of the liquid in a quarter of an hour; precipitate of the same color.

All these precipitates having the color of those produced by arsenic with the same reagents, we thought it necessary to determine their nature, and to ascertain whether they have any other origin.

(*To be concluded in our next.*)

ANALYSIS OF THE LIVER OIL OF DIFFERENT SPECIES OF THE GENUS GADUS.*

BY M. DE JONGH.

M. FREMY intends to give an abstract, in an early number of this journal, of Berzelius' last Annual Report on the Progress of Chemistry. Without wishing to anticipate the work which our colleague has reserved to himself, we think it right to extract from this work the principal results of M. de Jongh's investigations concerning cod-liver oil; the more and more important part which this oil takes in therapeutics, appears to us to give interest to this publication. The author has examined, from Bergen, which is procured from different species of *Gadus*, (*Morrhuur*, *Moloa*, *Carbonarius*, *Callarius*, *Pollachius*, and *Milanghius*), that of the cod is the best and the most abundant. Three varieties of cod-liver oil are known: the white liver oil, which separates first, and spontaneously, from livers piled up in tubs; the brown oil, which separates afterwards; and the black oil, which floats on the water with which the livers, which have already furnished the white and brown oils, are boiled.

M. de Jongh analysed these three oils, which he had received direct from Bergen.

He first treated the oil by water, in order to extract all the portions soluble in that liquid; he afterwards saponified it, in order to study the fatty acids, glycerine, and other matters which were separated from this operation. Finally, he determined the phosphorus by destroying the oil by very small portions at a time, by means of nitric acid.

The following table presents the centissimal result of this analysis :—

ONE HUNDRED PARTS OF LIVER OIL CONTAIN :

	BLACK.	BROWN.	WHITE.
Oleïc acid, gadnin, and two other matters not studied	69·78500	71·75700	74·03300
Margaric acid	16·14500	15·42100	11·75700
Glycyrine	9·71100	9·07300	10·17700
Butyric acid	0·15875	—	0·07436
Acetic acid	0·12506	—	0·04571
Fellinic and cholinic acids, impregnated with a little fat	0·29900	0·06200	0·04300
Bilifulvin and bilifellinic acid, and some matters not ascertained	0·87600	0·44500	0·26300
Peculiar matter soluble in alcohol at 30°	0·03800	0·300	0·00600
Matter insoluble in water, alcohol, and ether	0·00500	0·00200	0·00100
Iodine	0·02950	0·04060	0·03740
Chlorine and little homine	0·08400	0·15880	0·14880
Phosphoric acid	0·05365	0·07890	0·09133
Sulphuric acid	0·01010	0·08595	0·07100
Phosphorus	0·00754	0·01136	0·02125
Lime	0·08170	0·16780	0·15150
Magnesia	0·00380	0·1230	0·00880
Soda	0·01790	0·06810	0·05540
Loss	2·56900	2·60319	3·00943

The black liver oil contained also a trace of oxide of iron. Its color is due to a matter which exists equally in the three oils, but which is first yellow, and takes a deeper brown tint, under the influence of the air. This matter accompanies the oleïc acid in its combination with the oxide of lead, when it is separated from the margarate of lead by means of ether.

Wishing to ascertain the nature of this matter, M. de Jongh saturated the oleïc acid with a soda ley, so concentrated that the oleate of soda could not be dissolved in it. He thus obtained a liquor of a deep brown color, which, saturated by sulphuric acid, left yellowish-brown flocks. These flocks, collected on a filter, were dissolved in alcohol at 0·87°, and the solution evaporated gave an amorphous residue of a brown-black, incompletely soluble in alcohol and ether. This residue, again treated by alcohol, gave a solution which was evaporated to dryness: the product was in its turn submitted to the action of alcohol, and these manipulations,

* *Journal de Pharmacie*, May, 1844.

thus repeated five times, gave a solution which was precipitated by an alcoholic solution of acetate of lead. M. de Jongh decomposed the well-washed precipitate with carbonate of soda—separated the carbonate by filtration—precipitated the solution by dilute sulphuric acid—and collected the flocculent brown precipitate, which was afterwards washed and dried. He thus obtained a dark brown, inodorous, and insipid matter, to which he gave the name of gadnin.

The matter, submitted to dry distillation, gave no trace of ammonia; it is soluble in water, and imperfectly soluble in alcohol and ether. Concentrated sulphuric acid dissolves it by aid of heat, and acquires a blood-red color; it does not dissolve in nitric acid at a moderate heat; chlorine decolors it, the alkalies change it, and acquire a reddish-yellow color. It is hard, and breaks in brilliant and translucid fragments, which give a powder of a fine red. Its formula in the free state is $C^{35}\ H^{46}\ O^{8}$, and in combination with a base are $+\ C^{35}\ H^{44}\ O^{8}$.

The author afterwards examined the brown matter insoluble in alcohol and ether, which is obtained by evaporating to dryness the solutions of gadnin, and drying the residue at 212° F.

M. de Jongh separated by distillation two volatile acids from cod-liver oil: butyric and acetic acids. The presence of this latter acid, under such a form that it cannot be extracted from it by means of water, is remarkable; it seems, indeed, says Berzelius, that it is contained in these oils in the state of a peculiar fat, which would be acetate of lipule. I may make some observations on this succinct abstract of M. de Jognh's memoir, which have appeared to me calculated to point out its consequences, particularly in a therapeutical point of view.

In examining the list of the numerous products which he has extracted from liver oils, it is evident that, independently of gadnin, fatty bodies, materials of the bile, of which they are in great part formed, and of iodine, which analysis has long since indicated in it, they contain chlorine, bromine, and phosphorus. The presence of these three bodies, endowed with such energetic properties, presents new means of explaining the quite special influence of these oils on certain diseases, which influence has hitherto been attributed to iodine, and which does not belong to it exclusively.

The discovery of phosphorus is a fact of the highest importance. This powerful excitant acts, doubtless, a great part in the properties for which the small proportion of iodine which has hitherto been found in them, did not satisfactorily account. It is to the phosphorus, in all probability, that the marvellous action of these oils, in cases of rachitis, in which, according to the judicious remark of M. Gobley, their efficacy seemed to be explicable only by phosphorus being discovered among their elements, must especially be attributed.

The work of M. de Jongh enlightens us concerning the relative value of the black, brown, and white liver-oils. It results from his experiments that phosphorus, bromine, chlorine, and iodine, are found in much more considerable quantity in the white oil, and especially in the brown than in the black, and that there exists a certain relation of proportions between these different bodies, so that the oil which contains the most iodine, for example, is also that which contains the most chlorine and bromine; with regard to phosphorus, the white oil contains a larger quantity than the others.

Another point likewise worthy of interest is, the quantity of iodine found by M. de Jongh in the liver oils represent a much larger proportion of iodide of potassium than MM. Girardin and Preissat found in cod-liver oil, and than skate-liver oil recently furnished to M. Gobley.

Let us admit, indeed, that a quart of each of these oils weighs 928 grammes,* the proportion of iodine observed by M. de Jongh in the brown oil of Bergen, 0 gr. 040 in 100 grammes, corresponding to 0·05246 of iodide; this quantity multiplied by 9·28 gives 0·4866 grs. in a quart of oil. Now, according to MM. Girardin and Preissat, there would be only 0·15 of iodide in the cod-liver oil which they analysed, and, according to M. Gobley, skate-liver oil would contain 0·25 centigrammes per quart, that is to say, nearly half less than the brown oil of Bergen. Are these considerable differences owing to the processes of analysis, or to the nature of the oils? This is a question to be examined, and new investigations are evidently necessary for fixing the opinions concerning the composition of liver oils; be it as it may, the labors of M. de Jongh certainly throw new light on the history of these oils. The consequences which flow from them should excite, in a high degree, the attention of physicians and pharmaceutists, and encourage them to undertake new experiments to make known all the resources which skate and cod-liver oils may present to therapeutics.

* The density of skate-liver oil is 928, according to MM. Girardin and Preissat.

ON THE ACTION OF CERTAIN ESSENTIAL OILS ON THE ANIMAL ORGANISM.*

BY DR. MITSCHERLICH, PROFESSOR AT THE UNIVERSITY OF BERLIN.

The action of essential oils has not hitherto been examined, and it is only as regards oil of turpentine that the symptoms caused by swallowing large doses have been noticed. Dr. Mitscherlich has made experiments with several of them, which show the greater or less poisonous energy of certain of these oils. These experiments demonstrate the passage of these oils into the circulation, and their elimination by pulmonary exhalation, and partly, also, by the renal excretion; they also make known the symptoms to which they give rise, and which determine death; finally, the *post mortem* appearances observed in the stomach, intestines, &c., after this kind of poisoning. Unfortunately, they do not furnish us with any information concerning the *modus operandi* of these substances. The following are the conclusions which the author has drawn from observations made on animals (rabbits, dogs, &c.).

I. VOLATILE OIL OF MUSTARD.

1. Oil of mustard is a violent poison; it kills animals in a shorter space of time than the other essential oils mentioned further on.

2. It causes a local inflammation which, however, is not very powerful in the intestinal canal; this inflammation causes a strong detachment of the epithelium, without occasioning any alteration in the arrangement of the cellular tissue.

3. It is absorbed, and its odor allows of its presence being easily detected in the abdominal cavity, and in the blood.

4. It is partly rejected by the pulmonary exhalation; and, in this case, it communicates to the urine an odor of horse-radish.

5. In cases of poisoning by this oil, the muscular irritability remains a long time after death.

II. VOLATILE OIL OF SAVINE.

1. Oil of savine is a violent poison, but does not kill so quickly as oil of mustard.

2. It is absorbed, as may be recognised by its odor, in the abdominal cavity, and in the blood.

3. It is partly thrown off by the pulmonary exhalation, and partly also by the urinary secretion as its odor demonstrates.

4. It occasions, even in mortal doses, only very little change in the intestinal canal, and only congestion of the blood vessels which are distributed in the jejunum with a detachment of the epithelium.

5. Its action on the veins is such, that, after death, these organs are gorged with blood; and, in one case, cylinders might be observed in the urine, which were probably formed by the internal membrane of the urinary canals of Bellini. The muscular irritability remains long after death, and the heart, whose cavaties which is gorged with blood, gives pulsations also for a long time.

III. VOLATILE OIL OF CARRAWAY.

1. Oil of carraway is a violent poison; however, its poisonous action is inferior to that of the two foregoing oils.

2. It is absorbed, as may easily be recognised by its odor, in the abdominal cavity.

3. It is partly rejected by the pulmonary exhalation, but the urine does not present any indication of it.

4. It determines changes of structure in the stomach and jejunum, but without producing inflammation in them, or even congestion of blood.

IV. VOLATILE OIL OF FENNEL.

1. Oil of fennel is a violent poison; but, nevertheless, weaker than the foregoing essential oils.

2. It is absorbed, as may be detected by the odor which the abdominal cavity exhales.

3. It is partly rejected by the pulmonary exhalation, but the urine does not present the slightest indication of it.

4. It causes in the intestinal tube a change of structure similar to that referred to in speaking of oil of carraway.

V. VOLATILE OIL OF TURPENTINE.

1. Oil of turpentine is a much weaker poison than the four preceding essential oils.

2. It is absorbed, as has already been proved by Hertwig and other experimenters, and it is very distinctly recognised by its odor, as well in the air expired, as in the abdominal cavity.

3. It is partly rejected by the pulmonary exhalation, and it communicates to the urine a specific odor, a fact long known.

4. In the experiments of Professor Mitscherlich, it did not cause inflammation of the stomach, but a very peculiar change in the structure of that organ, with a considerable detachment of the epithelium and formation of sanguinolent phlyctenes.

5. It is not only to the stomach and jejunum that the detachment of the epithelium is confined, as in the case with the volatile

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* *Journal de Chimie Médicale*, June, 1844.

oils, spoken of above; but the oil of turpentine, when it arrives in the large intestine, determines a similar effect, and it is thus that it gives rise to a purgative effect and to alvine evacuations of a mucous nature.

ON THE ADULTERATION OF SOME CHEMICAL PRODUCTS, WITH THE INDICATION OF ECONOMICAL MEANS FOR DETECTING THEIR PURITY.*

BY GIOVANNI RIGHINI, OF OLEGGIO.

I. MEANS OF PROMPTLY DETECTING THE PRESENCE OF ALCOHOL IN THE ESSENTIAL OILS.

Alcohol has the property of dissolving the essences. The following is the means which I have not long since put in practice for detecting its presence in some volatile oil of bergamot which was sold as *very pure*, by distiller of essences.

15 grammes of pure olive oil (oil of almonds may likewise be used) are mixed with a like quantity of the essence to be tested: if the latter contains alcohol, the latter body immediately separates in the same manner as the molecules of water separate from the fixed oils with which they have been mixed. If, on the contrary, the volatile oil mixes perfectly with the fixed oil, it may be concluded that it does not contain alcohol.

II. ALTERATION OR ADULTERATION OF MEDICINAL HYDROCYANIC ACID.

I have sometimes found medicinal Prussic or hydrocyanic acid replaced by concentrated water of bitter almonds. It is by means of the following processes that I am able to distinguish these two preparations from one another:—A little of the suspected acid is poured into a phial, which is afterwards placed in a sand-bath. Then, a piece of blue litmus-paper is held over the mouth of the phial. In proportion as the acid tested is gently heated, the hydrocyanic acid is disengaged and reddens the test-paper. This effect is not produced when the liquid operated on consists only of hydrolate of bitter almonds.

III. NEW MODE OF DISTINGUISHING HYDROLATE OF CHERRY-LAUREL FROM HYDROLATE OF BITTER ALMONDS.

M. Veltmaun has discovered in ammonia a reagent for hydrolate of cherry-laurel, and for hydrolate of bitter almonds, by the production of a whitish precipitate which is formed in a very short time when this reagent is poured by drops into the last of these two distilled waters; whilst with the first, that is to say, with that of cherry-laurel, the white precipitate is not instantaneous and is formed only after a very long time.

Some time ago, I observed that, by adding a few drops of liquid sulpho-tartrate of quinine, to the concentrated hydrolate of cherry-laurel, the liquor immediately turned very white, and that a white precipitate was formed.

A few drops of the same saline solution, poured into the concentrated hydrolate of bitter almonds, give rise not to a whiteness, but only to the precipitation of some white globules, and the liquid immediately recovers its former limpidness, whilst the white tint which the distilled water of cherry-laurel takes is maintained at the same degree for a certain time, and furnishes after a long time a very copious precipitate compared with that which is produced in the concentrated hydrolated bitter almonds.

As regards the water of bitter almonds, which is not concentrated, as when prepared according to the formula of certain pharmacopœias, it does not give any reaction with the salt mentioned, doubtless on account of the too small a portion of hodrocyanic acid which it contains.

Sulpho-tartrate of quinine should, therefore, on account of its more prompt reaction, always be preferred to ammonia for distinguishing a concentrated hydrolate of cherry-laurel from hydrolate of bitter almonds.

IV. NEW MEANS OF ASCERTAINING THE PURITY OF MYRRH.

The following is the process by means of which I am enabled to discover whether myrrh is pure or altered by the mixture of other gum-resins:—4 grammes of myrrh, and the same quantity of very pure hydrochlorate of ammonia are reduced to a fine powder, then the two powders are mixed and triturated together for a quarter of an hour, after which from 60 to 100 grammes of water are gradually added, the trituration being continued all the time.

If the mixture is promptly dissolved in the liquid, it is a certain indication that the myrrh is pure, and does not contain foreign substances.

V. NEW MEANS OF ASCERTAINING THE PURITY OF THE RESIN OF JALAP, OF FACILITATING ITS ADMINISTRATION IN THERAPEUTICS, AND, CONSEQUENTLY, OF RENDERING ITS ACTION ON THE ORGANISM MORE ENERGETIC AND MORE PROMPT.

It is known that in pharmacy and chemistry, for ascertaining the purity of the

* *Journal de Chimie Médicale*, June, 1844.

resin of jalap, we avail ourselves of the property which absolute alcohol possesses of completely dissolving it when it does not contain foreign matters. But, colophane and resin of guiacum, with which it is ordinarily mixed in commerce, are equally soluble in this menstruum, which cannot consequently attain the object proposed, that of detecting its adulteration.

A substance which makes known, with certainty, the purity of the resin of jalap, and which in this respect justly deserves attention, is the syrup of rhubarb. It should be employed in the following manner:—

The desired quantity of the resin of jalap is taken, reduced to a very fine powder in a mortar, then triturated with a sufficient proportion of syrup of rhubarb. By diluting the mixture with water, the resin, if pure, is presented in the state of perfect division in the solution; this is not the case when it is mixed with foreign bodies.

This peculiar property of the resin of jalap presents, also, a valuable advantage to therapeutics; for, thus divided in the syrup of rhubarb, it can come in contact with a greater extent of the gastric surface, which allows of it producing its therapeutic effects, without the necessity of giving it in such large doses as hitherto. Thus, 15 or 20 centigrammes of this resin, divided in syrup of rhubarb, and diluted with from 60 to 100 grammes of water, are sufficient for four or five alvine evacuations, even in robust individuals. In some subjects I have even seen this medicine, thus administered, act as an emeto-cathartic. In a word, the purgative power of the resin of jalap is increased by this new mode of dilution to this exsent, that practitioners can no longer use it except with a certain degree of circumspection.

In order to avoid, moreover, all error in a pharmaceutical point of view, I should here mention, that I prepare the syrup of rhubarb with the extract of that root, and by neutralising by the subcarbonate of potassa, the free acid which exists in the rhubarb at the time of the preparation of the extract itself.

FORMULA FOR A BLISTERING PLASTER.*

BY M. HOUDBINE.

The blisters prepared by M. Fumouze Albespeyre being very easy of employment, especially for carrying into the country, I was obliged to make some in order to satisfy the demands made upon me. Being desirous of avoiding this species of monopoly, I have long prepared a blistering plaster, whose action is very prompt and certain. I send you my formula, in order that you may insert it in the *Journal de Chimie Médicale*, if you think it useful to our brethren.

℞—Purified Burgundy pitch.. 60 parts.
Purified resin of elemi.... 60 ,,
Oil of cantharides ..... 60 ,,
Yellow wax..... 125 ,,
Cantharides, in fine powder 125 ,,
Sulphuric ether..... 125 ,,
Camphor, in fine powder . 20 ,,

I place the finely powdered cantharides in a vessel; I add the ether, cork, and leave in contact for eight days. I then melt, over a gentle fire, the Burgundy pitch, the wax and the resin of elemi, with the oil; I add the cantharides, and keep the mixture in fusion for at least two hours, taking care to stir occasionally: finally. I mix the camphor in very fine powder. I employ for making my plaster cloth waxed on one side only, the plaster adhering to it better than when the surface on which it is spread is smooth.

By following this formula, every pharmaceutist may be freed from the necessity of having recourse to another to procure a convenient plaster, and which may be made as easily as any other plaster.

* *Journal de Chimie Médicale*, March, 1841.

ON THE IMPURITY OF SOME DRUGS.*

BY DAVID MURDOCH, ESQ.

(Read before the Philosophical Society of Glasgow, March 27, 1844.)

I. CALAMINE, OR CARBONATE OF ZINC.

As the calamine, or impure carbonate of zinc, sold in London, had been frequently examined by Dr. R. D. Thomson, and found always destitute of zinc, it became a matter of some interest to ascertain if the same remark applied to the calamine which occurs in commerce in Glasgow. Accordingly, at the request of Dr. Thomson, a specimen was subjected to analysis. The color of this substance is well known to be a light red. When it is boiled with muriatic acid it effervesces slightly, and becomes perfectly white, the residue consisting of a heavy white powder, which, on being heated on charcoal before the blow-pipe, and then digested in acid, gives out the smell of sulphohydric acid; and when fused with carbonate of soda and digested with water, sulphate of soda is dissolved and carbonate of barytes remains unacted on. The main constituent of the

* *Lancet*, June 8, 1844.

commercial calamine is thus, obviously, sulphate of barytes. To ascertain if any zinc was contained in the red powder, the acid solution which was boiled upon it was mixed with a quantity of caustic ammonia in excess, which precipitated the peroxide of iron and alumina. This precipitate was filtered, and the ammoniacal liquid which passed through the filter was precipitated by oxalate of ammonia. The oxalate of lime was thrown on a filter, and the washings evaporated to dryness and heated to low redness in a platinum capsule. No residue was left; showing the absence of zinc and magnesia.

128·05 grains of calamine gave, in one analysis, of sulphate of barytes and silica, 128·05; peroxide of iron and alumina, 11·55 grains; water, 0·51 grains; and the result of two analyses were as follows:—

	I.	II.
Sulphate of barytes.....	88·74	89·77
Peroxide of iron and alumina	8·01	5·74
Carbonate of lime.....	2·90	4·40
Water	0·35	0·35
	100·	100·26

Dr. Thomson having suggested that the mode in which this adulterated article was manufactured was by mixing together a portion of American bole, chalk, and sulphate of barytes, the next object was to examine American bole, for the purpose of comparison. The following are results of several analyses of this substance, which is used extensively for coloring tooth-powders, &c., by druggists. The fourth analysis was made by my brother, Mr. James Murdoch:—

	I.	II.	III.	IV.
Silica.....	50·15	47·31	..	49·38
Peroxide of iron	22·69	..	..	30·44
Alumina...	11·46	32·96	31·	6·90
Lime.....	6·43	..	..	..
Water....	..	..	..	7·04
Sulphate of lime	..	..	..	8·30
Magnesia..	..	..	..	1·98

To determine if any silica was contained in the sulphate of barytes of the adulterated calamine, the sulphate was fused with carbonate of soda, the fused mass washed with water until the sulphate of soda was removed, and then the residue was digested in dilute muriatic acid. A portion of silica remained undissolved; the quantity was not determined, but it is obvious that the calamine contains all the substances existing in American bole, and the conclusion is scarcely avoidable that the color is caused by the presence of the body.

II. PRECIPITATED SULPHUR.

This substance, also termed milk of sulphur and washed sulphur, is properly prepared by boiling sulphur with lime or potash, precipitating the solution with muriatic acid, and throwing the precipitated sulphur on a filter and washing it. If this form of sulphur were always prepared in this manner, no impurity would exist in it. But it has been observed that this article, in London, as least, contains always above one half its weight of impurity. To ascertain if this substance, in Glasgow, was equally impure, 58·85 grains were ignited in a platinum capsule and were found to lose 29· grains. This would make the composition of the sulphur—sulphur 49·27, and sulphate of lime 50·73. But as the gypsum was in crystals it obviously contained its water of crystallisation, which must, therefore, be calculated. The constituents of hydrous gypsum are—Ca O = 3·5 S O_3 = 5 2 H O = 2·25 = 10·75. The quantity of water belonging to the sulphate of lime found in the analysis will therefore be 13·42 per cent. The true constituents then are:—

Sulphate of lime.....	50·73
Water of crystallisation.....	13·42
Sulphur.....	35·85
	100·

III. OXIDE OF ZINC.

This oxide generally effervesces on the addition of an acid, proving the presence of carbonate of zinc or of the carbonate with which it has been precipitated. When, to the solution of this oxide in muriatic acid, an excess of caustic ammonia is added, some brownish-red flocks of peroxide of iron remain undissolved, containing, perhaps, a little alumina, amounting to about one-half per cent.

IV. RED OXIDE OF IRON.

This oxide, as sold in the shops, has been examined by my brother, Mr. James Murdoch, and found to contain a small percentage of alumina.

V. TARTAR EMETIC.

This salt generally contains a small quantity of peroxide of iron.

Glasgow College, Laboratory.
April, 1844.

Note by Dr. R. D. Thomson.—The first person who published an account of the extraordinary mixture called calamine in the shops was Mr. Brett, in the "British Annals of Medicine," vol. i., p. 485. He found,

however, traces of lead and zinc in the specimens which he analysed, a circumstance which has never occurred to me, either before or since that period. It is possible, therefore, that the specimens may vary slighly; sulphate of lead is a probable ingredient, in minute quantities; but I very much doubt if the manufacturer of this article is honest enough to supply his customers with even a trace of zinc. It is not a little remarkable that this adulterated article should have, for so long a period, been infesting every drug-shop, to the utter exclusion, apparently, of the genuine article in England and Scotland, without any complaint from those who purchase it. Does this fact not prove that as calamine is used in the form of ointment, it is the lard which is the efficient application. Mr. George Schweitzer, of Brighton, first published an account of the impure smell of sulphur in the "British Annals of Medicine," in 1837, vol. i., p. 618, and showed that the sulphate of lime was introduced by substituting sulphuric acid for muriatic acid in the precipitation of the sulphur from its base. I may mention that this adulteration is easily detected by the microscope, the crystals of sulphate of lime being very apparent. It is not easy to discover any other method of excluding such adulterated articles from commerce unless by the acquisition of a scientific knowledge of chemistry by the druggists of this country.

PREPARATION OF TANNATE OF IRON.*

By mixing oxide of iron, or ferruginous saline solutions, with an infusion of nut-galls, a precipitate is obtained, which, in great part, passes through the filter. This latter effect may be prevented by adding to the mixture a little carbonate of potassa, and then an abundant precipitate is obtained, which may be washed.

This peculiarity explains why old authors recommend the addition of a certain quantity of vinegar to the ingredients destined for the composition of ink.

ON SOLANINE.†

BY DR. HERMANN BAUMANN.

M. Baumann undertook a series of long and interesting experiments on solanine, and the results which he has obtained, as well as those already published by other observers, have led him to the following conclusions:—

1st. Solanine is found in the potato.

2nd. It exists in the stalks and leaves of the potato, as well as in that of most plants of the family *Solanaceæ*.

3rd. It is met with in greater quantity in the germs, in smaller quantity in the stalks and leaves, and the tubercles contain the least of all.

4. By boiling potatoes in water, the solanine is at least partially eliminated.

5. Wakenroder's method appears to be the best for the extraction of solanine.

6. Solanine forms with the acids salts which are partly crystallisable, and partly amorphous; many of them have a great tendency to be converted, by the contact of water, into acid and basic salts: this effect especially takes place with the amorphous salts.

7. Solanine, as well in substance as in the solid state, acts, even in small doses, in a very energetic manner on the animal organism; but, if it is rejected by vomiting, it does not leave any bad consequences.

8. It should not be ranked among the alkaloïds, which act in a lethal manner, although in certain circumstances it may be so.

JANIUS' PERPETUAL BLISTER.*

℞—Cantharides ..... 60 parts.
Euphorbium ..... 30 ,,
Pulverise and incorporate warm in Turpentine .... 360 ,,
Add,
Mastic ..... 360 ,,
Stir until perfectly cold.

The following formula is also pointed out:

Mastic ..... 90 parts.
Turpentine ..... 90 ,,
Wax ..... 30 ,,
Melt and add,
Cantharides, in fine powder .. 37 ,,
Euphorbium ..... 15 ,,
Mix intimately.

PREPARATION OF BROMIDE OF IRON.†

℞—Iron filings .. 30 grammes

This substance is introduced into a glass flask, which can be hermetically sealed; then there is added—

Distilled water .. 90 to 100 grammes;

* *Jahrbuch für Praktische Pharmacie.*
† *Archiv der Pharmacie.*

* *Journal de Chimie Médicale*, March, 1844.

† *Pharmacopœia Universalis* of Geiger and Mohr.

Then there is gradually poured on the whole,

Bromine.... 10 grammes.

The flask is carefully corked, and agitated, from time to time, until the liquor takes a greenish tint; after which the product is filtered, and promptly evaporated until dry.

The bromide of iron has a brick-red color; it is deliquescent, readily dissolves in water, and has a very styptic taste.

POISONING BY OIL OF BITTER ALMONDS.*

BY W. SMITH, ESQ., CLIFTON.

The subject of the following case was a young lady, ætat. eight years and a half, who took what is called by the druggists "ratifia." This substance consisted of one drachm of the essential oil of bitter almonds to seven drachms of spirit. It contained, therefore, rather more than seven drops of the essential oil to each drachm. It is frequently used for culinary purposes, to flavor custards, &c. Rather more than two teaspoonfuls were gone from the small bottle, probably about a teaspoonful was swallowed.

Arriving almost immediately after the accident, I found another medical man present, and the symptoms of our little patient were as follows:—

In the circulating system—There was no radical pulse on either side. The extremities seemed almost bloodless; the face, however, was of the usual tint; there was considerable swelling of, and undulatory motion in, the jugular veins; the carotids beat quickly and fully.

Muscular system—There was no spasm in either extremity; the limbs were completely lax and fell lifeless when lifted; the eyelids were closed, and the eyes both drawn to the left side; the jaw was firmly clenched in rigid spasm; the pupil was dilated.

Respiratory system—There was no stertor in the breathing, which was slow and gentle.

The eye had a brilliant and glassy appearance throughout,—*mere physical brilliancy without mental expression.* There was perfect insensibility.

Treatment.—Cold water had been thrown over the arms by a lady present, who thought the child had fainted. We administered a mustard emetic, and immediately afterwards brandy and water with aromatic spirit of ammonia. The child vomitted after the administration of the latter. The vomitted matters smelt strongly of hydrocyanic acid. A jar of hot water was applied to the feet, the arms were assiduously chafed, and the aromatic spirit of ammonia rubbed into the pit of the stomach. The brandy and ammonia were administered at short intervals, and after about twenty minutes' continued exertions we had the pleasure to feel the radial pulse returning, at first very feebly and quick, but gradually gaining power. The spasm of the jaw (which we had been obliged to open by introducing the handle of a nail-brush) gradually relaxed, and the little patient shortly afterwards opened her eyes, and was enabled to answer questions. The case went on very favorably, and she has since done well. During the insensibility ammonia was not only administered internally, but the bottle was held to the nostrils, and as the effects of the poison were lessening the child turned away from it, thus showing a returning susceptibility to its odor. She had no recollection of what occurred from the time of her taking the poison.

Remarks.—The undulation of the blood in the jugulars, the beating of the carotids, the rosy tint of the cheeks, as well as the spasm of muscles of the jaw and eyes, form a singular contrast with the apparent absence of all phenomena of life in the rest of the body, and seemed to indicate an accumulation of vitality in the brain. Is the action of the heart paralysed when prussic acid is taken, in the same way as occurs in a sudden apoplectic seizure, *i. e.*, by a primary action through the circulation on the brain? In other words, is the primary action of prussic acid that of causing congestion of the brain?

Clifton, June 1, 1844.

* *Lancet*, June 8, 1844.

NUTRITIOUS ALIMENTS.

Those alimentary principles, which possess the double quality of being pleasant to the taste as well as nutritious, are necessarily the most beneficial, especially to invalids; for their grateful flavor enables us to partake of a larger proportion of them, and, therefore, to become better supplied with nutriment than if the substance were insipid and flavorless. Among the extended list of *pleasant* nutrients, we may mention the "Nutritious Farina" of Mr. Bright, which is, without exception, one of the most wholesome and delicious preparations we have met with for a long time. We strongly recommend those of a sick and weakly habit—those to whom physicians recommend light nourishment, to procure some of this excellent preparation, and to use it as Mr. Bright dictates.

MR. COLES'S TRUSSES.

We have received from this enterprising mechanician a specimen of his *poetical* capabilities, and we assure our readers that they would be highly gratified by its perusal; but we are so much pressed for space that we are compelled to refrain from publishing it. However, it may be well to state, in justice to Mr. Coles, that, although now and then garnished by the usual licence of the poet, it contains several facts which show that the author has some claims upon the public for support. Mr. Coles has followed the capacity of truss maker for many years, during which period he has unceasingly pursued his daily avocations with great avidity; and he has now in his old age, the satisfaction of knowing that he has conferred, sometimes, we believe, disinterestedly, many a boon on his fellow creatures, having relieved thousands of suffering mortals from those distressing maladies — Hernia, Rupture and Rheumatism.

We heartily wish that Mr. Coles may continue to hold the position he now does for many years to come, as, when he leaves us, we shall scarcely know where to send our suffering brethren for relief.

BOOK RECEIVED.

"An Essay on the Constitution of the Earth."

TO CORRESPONDENTS.

"D.B." will receive a letter by the 2nd inst.

"M. P. S."—In all probability.

"An Associate."—We predicted the same some time since.

"Dr. W. G." will find the information he requires in "Liebig's Animal Chemistry."

"A."—Your letter was answered as you requested.

"P. P."—We regret not being able to assist our correspondent in his views; it is a matter in which we cannot interfere.

"N."—The sulphate of alumina.

"M.R.C.S."—Raise your solution to the temperature of 120° F.

"An M.P.S."—*All* their proceedings are disgraceful.

"X.Y.Z." will find the required information at the post-office he mentioned.

"A Constant Reader."—You are very wrong.

SUMMARY OF METEOROLOGICAL OBSERVATIONS MADE AT OTLEY, YORKSHIRE, IN MAY, 1844.

BY E. THOMPSON.

BAROMETER.

Monthly mean	30·01
Mean at 9 a.m.	30·01
,, at 3 p.m.	30·00
,, at 9 p.m.	30·02
Maximum on 2nd	30·35
Minimum on 7th	29·68
Range	·57

THERMOMETER.

	DEG.
Monthly mean	50
Mean of maxima	57
,, minima	43
Maximum on 1st	68
Minimum on 18th	34
Range	34

WIND.

Days.		Days.	
N.	2	S.	0
N.E.	12	S. W.	1
E.	1	W.	6
S. E.	2	N. W.	4

WEATHER.

	Days.		Days.
Clear	9	Snow	1
Cloudy	16	Frost	1
Overcast	1	Hoar frost	0
Showers	1	Mist	2
Rain	0	Hail	2

GENERAL REMARKS.

A month remarkable for drought. Only a few drops of rain have fallen during the whole period. The barometer has been uniformly high during the latter half of the month. North winds have kept down the temperature. Vegetation has been brought nearly to a stand.

Nota Bene.—*All Communications, Books for Review, and Substances to be Analysed, must be addressed "To the Editors of the Chemist, 310, Strand, London." Communications must be prepaid, and sent before the 15th of each month; Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

ON THE PREPARATION OF SULPHO-HYPOSULPHATE OF POTASSA.

BY MATHIEU PLESSY.

M. Langlois, to whom is due the discovery of sulpho-hyposulphuric acid, obtained this acid in combination with potassa, by causing sulphur to react on bisulphite of potassa. The following is M. Langlois' *modus operandi*:—He prepares bisulphate of potassa by passing sulphurous acid into a solution of pure carbonate of potassa until it absorbs no more. He introduces the salt thus obtained into a flask containing flowers of sulphur, and puts the whole in digestion in a sand-bath, whose temperature should not be high enough to boil the mixture. Sulphurous acid is disengaged, and sulphate is produced; the liquid assumes a yellow tint. After three or four days, when the new combination is completely formed, this tint disappears; it is, therefore, a certain indication of the end of the operation. The liquid, filtered hot, becomes turbid and milky by cooling, and crystals, covered with a little sulphur, are obtained; they are purified by solution in a very little lukewarm water. The filtered solution is no longer turbid, and furnishes very fine prismatic crystals.

M. Langlois, at first thought to isolate hyposulphurous acid by decomposing these crystals by perchloric acid; the process which furnished them to him, and which has just been described, being that prescribed for the preparation of hyposulphite of potassa. Very soon after, he found that the acid which they contain does not present the composition of hyposulphurous acid, which is formed of three equivalents of sulphur, and five equivalents of oxygen.

Thus, when sulphur is dissolved in the bisulphite, a liquid is obtained which deposits a quantity of sulphur by boiling, and gives only a small quantity of sulphohyposulphite of potassa, and of an impure hyposulphite. The reaction does not, therefore, occur, as was at first believed; and, although sulphurous acid is disengaged, in the circumstances described by M. Langlois, we have not

$$KO(SO^2)^2 + S = KOS^2\,O^2 + SO^2$$

This disengagement of sulphurous acid, observed by M. Langlois, does not always take place. Thus, at from 77° to 86° F. it does not occur, and still the sulphur dissolves in the bisulphite.

If the bisulphite of potassa cannot serve for the preparation of hyposulphite, the neutral sulphite answers the purpose perfectly well.

I will briefly describe the process which I use for preparing hyposulphite of potassa by means of the neutral sulphite. It will not, perhaps, be useless to make it known, since it is likewise applicable for preparing hyposulphite of soda, which is an article of very considerable consumption.

Bisulphate of potassa is prepared as I have above pointed out, and when no more carbonic acid is disengaged, when the sulphurous acid traverses the liquid without being dissolved, its saturation is finished, and the carbonate of potassa is converted into bisulphite. This salt is then brought to the state of neutral sulphite by adding carbonate of potassa until no more effervescence is produced; then the neutral sulphite, thus prepared, is boiled in a capsule, or in a flask with flowers of sulphur, for fifteen or twenty minutes, and occasionally stirred with a glass spatula, in order to facilitate the solution of sulphur.

The liquid separated from the excess of sulphur, by filtration, is evaporated on the open fire to a syrupy consistence; at this point of concentration, if any sulphate be formed during the operation, a portion of this salt is deposited and collected next day. The clear liquid is decanted, concentrated a little more, which does not cause a fresh precipitation of sulphate, and, by the next day, in a dry place, fine crystals of hyposulphite are formed.

* *Annales de Chimie et de Physique*, June, 1844.

The presence of the sulphate, far from being injurious, determines, I think, a clearer crystallisation of hyposulphite. A concentrated solution of this pure salt does not seem to give such fine crystals.

The crystals of hyposulphite thus obtained are perfectly colorless, transparent, and hard. They are very soluble in water; they are not deliquescent in air which is not very moist; they contain two equivalents of water of crystallisation.

The hyposulphite of soda may be purified by fusing this salt in its water of crystallisation, by the action of heat. By cooling, very fine crystals of pure hyposulphite are formed which are separated from the supernatant liquid, which retains the impurities.

I will now point out the process by which I prepare sulpho-hyposulphate of potassa.

I obtain this salt by the action of sulphurous acid on hyposulphite of potassa. This very remarkable action, in some measure, explains the formation of $S^3\ O^5\ KO$ by the process of M. Langlois. Indeed, it may be admitted that sulphur, in dissolving in bisulphite of potassa, forms hyposulphite, and that the excess of sulphurous acid, instead of being disengaged, reacts on this salt in such a manner as to give the sulpho-hyposulphate. It was by supposing that it occurs thus that I was led to examine the action of sulphurous acid on hyposulphite of potassa.

The following is the mode in which I operate for obtaining M. Langlois' salt.

I procure a solution of hyposulphite of potassa so concentrated that it cannot mix with the alcohol of commerce marking 84 centesimal degrees. If water containing about $\frac{1}{8}$ of its volume of this alcohol be taken, and if either dry or crystallised hyposulphite of potassa be added to it, the alcohol will separate and rise to the surface. Then I add no more salt, and I drive in sulphurous acid produced with sulphuric acid and powdered charcoal; but I previously raise the temperature of the solution from 77° to 86° F. If the disengagement of gas is rather rapid, this temperature is maintained. From time to time a little hyposulphite is added, care being taken that the temperature remain always the same. If the liquid acquires an intense yellow color, and gives out the odor of sulphurous acid, the disengagement of this gas is arrested, and, after a few hours, the liquor is decolored, and completely loses the odor of sulphurous acid, and a great quantity of crystals are deposited. The supernatant alcohol then mixes with the liquid, which shows that a new quantity of hyposulphite must be added, and sulphurous acid passed in, if it be desired to obtain a greater quantity of crystals.

When a sufficient quantity of these crystals has been prepared, they are dissolved in water at from 122° to 140° F.: it is then filtered to separate the sulphur which they contain, and there is added to the filtered liquor $\frac{1}{8}$ of its bulk of alcohol of commerce at 84 centesimal degrees; it is then heated a little, and the solution, left to itself, furnishes, by cooling, perfectly pure, fine prismatic crystals. These crystals are quadrilateral prisms; their taste is slightly saline and bitter; by the action of heat they give sulphurous acid and sulphur, and leave a residue of 64·36 of neutral sulphate of potassa; they are neutral, and easily dissolve in water.

These crystals in solution, in water, are decomposed by sulphuric and nitric acids, depositing sulphur and disengaging sulphurous acid.

Hydrochloric acid does not decompose them; they do not give any precipitate with the solutions of lime, baryta, iron, zinc, magnesia, nickel, &c. They decolor the red sulphate of manganese, and do not act on a solution of sulphate of copper. They form a black precipitate with the salts of protoxide of mercury, and a blue one with those of the deutoxide, and give, with nitrate of silver, a yellowish-white precipitate; this precipitate very soon turns black. Hence, it is evident that the salt in question possesses all the properties of sulpho-hyposulphate of potassa.

The mother-liquor of the crystals, whose properties I have just made known, becomes turbid, and gives a deposit of sulphur when heated to a temperature which would not decompose a solution of sulpho-hyposulphate of potassa, and, by the addition of concentrated alcohol, it deposits a salt in which are distinguished crystals, whose crystalline form differs from that which the sulpho-hyposulphate possesses.

M. Gélis, to whom I have communicated these observations, informs me that the crystals should be bisulphuretted hyposulphate, since this salt is also produced by the reaction of sulphurous acid on the hyposulphite.

When M. Gélis thus apprised me that he was also studying this reaction. I was able to determine only approximately the quantity of sulphurous acid absorbed by a given weight of hyposulphite. It appeared to me, without, however, being certain of my results, that the absorption was in the ratio of $2^2\ (SO^2\ KO) + 3\ (SO^2)$.

It will be borne in mind that in operating on concentrated liquors a deposit of sulphur

is produced. It was important to ascertain whether this deposit was also formed with not very concentrated solutions. I have observed that it does not take place in this case, and yet there is an absorption of sulphurous acid. MM. Gélis and Fordos were able to make before me the analysis of the reaction which then occurs. This analysis led them to the following equation:—

$$2(S^2O^2KO) + 3(SO^2) = S^3O^5KO + S^4O^5KO.$$

I was able to extract the bisulphuretted hyposulphate from the mother-liquor from which the sulpho-hyposulphate of potassa was deposited; it is a white and not very stable salt, but which may be very well preserved in contact with the air when it is crystallised and dried.

When the absorption of sulphurous acid by hyposulphite of potassa has determined the precipitation of a certain quantity of sulphuretted hyposulphate and bisulphuretted hyposulphate of potassa, sulphate is found in the liquor. In a memoir which MM. Fordos and Gélis will shortly publish, they will inform us to what cause the formation of this salt must be attributed. I have observed that it is formed out of contact with the air; thus, when we pass a recently prepared solution of sulphurous acid in boiled distilled water into a bell-receiver over mercury, and afterwards a sufficient quantity of hyposulphite, we find, after 24 hours' repose, when the absorption of sulphurous acid is complete, that the liquor gives, with chloride of barium, a precipitate which does not entirely dissolve in weak hydrochloric acid.

MEMOIR ON BUTYRONE.*

BY M. G. CHANCEL.

M. Chevreul was the first chemist who submitted butyrate of lime to dry distillation: he noticed, among other products, the formation of an aromatic volatile oil, presenting an odor analogous to the essential oil of labiées. But, owing to the smallness of the quantities of butyrate, which the saponification of butter affords, this oil has not been the subject of any investigation.

However, M. Löwig has published an opinion relative to the nature of the product formed in these circumstances: according to this chemist, the formula of anhydrous butyric acid would be $= C^7H^6O^3$; by the distillation of the butyrates, *butyrone* would be formed, whose composition should be C^6H^6O. This formula of butyric acid entirely differs from that given by M. Chevreul, and it is rendered perfectly inadmissible by the recent investigations of MM. Pelouze and Gélis. It will be seen, on the other hand, that the distillation of a butyrate does not furnish, in any case, a substance whose composition may be represented by the formula C^6H^6O.

MM. Pelouze and Gélis having placed at my disposal a great quantity of butyrate of lime, I undertook the study of the products which the distillation of this compound furnishes; it is the first part of these investigations that I now have the honor of submitting to the judgment of the Academy.

DRY DISTILLATION OF BUTYRATE OF LIME.

Butyrate of lime, submitted to the action of heat, presents one of the most simple examples of decompositions of this kind. If a small portion of this pure and anhydrous salt be cautiously heated, it is speedily decomposed into carbonic acid which remains combined with the lime, and into a volatile oil which distils over: this oil is no other than almost pure and scarcely colored butyrone; the residue consists of pure and perfectly white carbonate of lime. By taking care not to exceed the temperature necessary for the formation of butyrone, and by operating on only a few grammes of matter, not the slightest trace of carbonaceous deposit is obtained.

Most frequently, no gas is disengaged, at least if the temperature be not raised too high; in this case, the quantity of gaseous product ordinarily amounts to 3 or 4 per cent. of the weight of the butyrate: the greater part is formed of bicarburetted hydrogen absorbable by sulphuric acid.

In no case, and it is a fact worthy of remark, is the slightest trace of water disengaged when anhydrous butyrate is operated on, although the disengagement of organic matters, as is known, almost always entails the formation of a certain quantity of water at the expense of the elements of the organic matter itself.

However, by distilling rather considerable quantities of matter, the operation is by no means simple; in this case, I have not been able to avoid the deposition of a certain proportion of carbon, and the liquid products obtained have always been very deeply colored; this is probably owing to the ultimate decomposition of a portion of the butyrone formed, in consequence of the unequal distribution of heat in the mass. There is also formed, in this case, a mixture of several liquid substances, in which, however, butyrone is the predominating product.

In several distillations, 100 parts of anhydrous butyrate of lime gave from 42 to 43 parts of crude butyrone.

* *Comptes Rendus*, No. 23, June 3, 1844.

BUTYRONE.

When the crude liquid obtained, as just described, is submitted to distillation, the boiling point, at first below 212° F., rapidly rises to 284° F. The liquid which passes over between 284° and 293° F., and which is no other than butyrone, is set aside; the portions collected before and after are a mixture of butyrone and two peculiar substances, one distilling below 212° F., the other above 320° F., and to which I intend to recur when I have been able to procure them in sufficient quantity.

The butyrone collected between 284° and 293° F. presents a constant boiling point; distilled for the last time, it may be regarded as pure.

Properties.—It is a colorless and limpid liquid, possessing a penetrating and peculiar odor; its taste is burning; its density is 0·83; it enters into ebullition at about 290° F.: submitted to the cold produced by the mixture of solid carbonic acid and ether, it assumes the form of a crystalline mass. It floats on the surface of water, in which it is almost insoluble, although it communicates its odor to that liquid; it dissolves in all proportions in alcohol. It is a readily inflammable substance, and burns with a luminous flame. The action of chromic acid on butyrone is most powerful; it immediately inflames in contact with that acid.

Exposed to the air, it is not colored, although it absorbs, in a long time, a very considerable quantity of oxygen.

Composition.—Several analyses of this substance, made with products arising from different preparations, have always given concordant results which lead to the formula $C^7 H^7 O$. The density of the vapor likewise confirms this formula. Experiment has given the number 4·0, which is very near the theoretical number 3·98. The formula $C^7 H^7 O$ represents therefore 2 volumes of vapor of butyrone.

This composition sufficiently explains the formation of this substance; butyrate of lime, submitted to distillation, is decomposed into carbonic acid which remains combined with the base, and into butyrone which distils over, as the following equation indicates:—

$$\underbrace{Ca\,O,\,C^8 H^7 O^3}_{\text{Butyrate of lime.}} = \underbrace{Ca\,O,\,CO^2}_{\text{Carbonate of lime.}} + \underbrace{C^7 H^7 O.}_{\text{Butyrone.}}$$

Thus, the dry distillation of butyrate of lime is not less clear than that of the acetate of the same base; the decomposition is operated with facility, and the quantity of butyrone which is obtained, in suitable circumstances, approaches very near to that indicated by theory.

ACTION OF NITRIC ACID ON BUTYRONE.

Nitric acid acts in a very clear manner on butyrone. When equal volumes of nitric acid of ordinary concentration and butyrone are mixed, the latter collects at the top and is colored of a deep red; if the matrass containing the mixture be moderately heated, after a few minutes and in a sudden manner a most vivid action is set up, red vapors are disengaged in torrents, and might even expel the liquid from the apparatus if the action of heat were not immediately stopped. The apparatus should be so arranged that the red vapors may traverse a vessel containing water; there is collected on the surface of this water a volatile liquid of a very agreeable ethereal odor, somewhat analogous to that of butyric ether. When the red vapors have ceased to be disengaged, the liquid contained in the matrass is poured into a very large quantity of water; there is separated, by this means, a nitrogenous acid which collects at the bottom of the water under the form of an oily liquid which is purified by repeated washing. This acid and the ether liquid above mentioned are the only two substances which are formed at the expense of the elements of butyrone; in this reaction only traces of carbonate acid are disengaged.

BUTYRO-NITRIC ACID.

Properties.—It is an oily liquid, of a deep yellow color, which does not congeal in a mixture of solid carbonic acid and ether; it possesses an aromatic odor and a very sweet taste. It readily inflames and burns with a reddish flame; it is insoluble in water, and soluble in all proportions in alcohol; its density is greater than that of water.

The properties which I have just noticed are common to the butyro-nitric acid arising directly from the action of nitric acid on butyrone, and to that extracted from the salt of potassa.

This acid readily combines with bases, and gives crystallisable salts.

From the comparison of a great number of analyses, made with the free acid, and with that combined, with bases, it results that butyro-nitric acid is a bibasic acid containing, in the free state, 2 equivalents of water, capable of being wholly or partially replaced by bases.

The following are the formula which express the composition of butyro-nitric acid and some butyronitrates:—

Free acid . . . . . $C^7 H^6 O, N O^4 + 2 H O$

Salt of potassa. . . . $\left.\begin{matrix}\\\end{matrix}\right\}$ $C^7 H^6 O, NO^4 + \left\{\begin{matrix}K\,O\\H\,O\end{matrix}\right.$

Neutral salt of silver $\left.\begin{matrix}\\\end{matrix}\right\}$ $C^7 H^6 O, NO^4 + 2\,Ag\,O$

Acid salt of silver . . .	$C^7 H^6 O, NO^4 +$	$\begin{cases} Ag\ O \\ H\ O \end{cases}$
Salt of lead . .	$C^7 H^6 O, NO^4 +$	$2\ Pb\ O$

From the inspection of these formulæ, it is evident that an equivalent of hydrogen has been eliminated in butyrone and replaced by an equivalent of nitrous acid; a case, moreover, analogous to those which many other organic substances present under the influence of nitric acid.

BUTYRONITRATES.

By mixing an alcoholic solution of potassa with butyro-nitric acid, the liquor begins by becoming slightly colored; a multitude of crystals shortly afterwards appear, which finally form a mass; these crystals are collected, and purified by washings with alcohol.

Obtained in this manner, butyronitrate of potassa is presented under the form of small plates of a fine yellow, whose appearance resembles that of iodoform. At a temperature near 212° F. it inflames with a kind of explosion: this property is common to all the butyronitrates which I have examined.

This salt of potassa is almost insoluble in alcohol; it dissolves in about 20 times its weight of water; its aqueous solution forms yellow precipitates with the salts of silver and lead, and a dirty green one in the salts of copper.

When a solution of butyronitrate of potassa is treated by nitrate of silver, a precipitate of butyronitrate of silver with two equivalents of base is formed; this salt, at first yellow, rapidly assumes a violet color. It is soluble in a great quantity of water, and crystallises by the spontaneous evaporation of the liquor.

The aqueous solution of this salt presents, at the boiling temperature, a very remarkable reaction: 1 equivalent of base is precipitated and replaced by 1 equivalent of water; so that the filtered liquor allows a salt to crystallise which has a composition analogous to the salt of potassa.

CHLOROBUTYRENE.

Distilled with perchloride of phosphorous butyrone is immediately attacked; phosphoric acid is formed, accompanied by a disengagement of hydrochloric acid; the liquid which distils over possesses a characteristic odor and contains considerable quantities of chlorine; but, in order to obtain a definite product, it is necessary to re-distil this liquid a great number of times with perchloride of phosphorus, for the action is exerted only with difficulty on the last traces of butyrone.

This substance is purified in the same manner as compound ethers.

Properties.—It is a colorless and limpid liquid, lighter than water, in which it is insoluble; it dissolves in all proportions in alcohol; it possesses a peculiar and penetrating odor; it is inflammable, and burns with a flame edged with green; it enters into ebullition at 240° F. Its alcoholic solution is not rendered turbid by nitrate of silver; but if, after it has been inflamed, this reagent be added to the residue of the combustion, considerable quantities of chlorine are rendered evident by an abundant precipitation of chloride of silver,

Composition.—Its analysis led to the formula $C^{14} H^{13} Cl$, which represents 4 volumes of vapor.

Nevertheless, experiment gives rather more carbon and less chlorine than this formula indicates; this is probably attributable to the presence of a small quantity of unattacked butyrone.

The study of the various reactions of butyrone and of the new compounds resulting from it, will be the subject of new investigations which I hope soon to be able to undertake, and which will form the completion of this first memoir.

I cannot conclude without thanking M. Pelouze for the kind assistance which he has granted to me in the course of these investigations.

INVESTIGATIONS CONCERNING IODINE.*

BY M. MILLON.

The investigations which I have the honor of communicating to the Academy relate to several facts, all of which may be connected with the history of iodine more particularly, but which, at the same time, may serve for elucidating the most general tendencies of chemical affinity.

All these facts are grouped under three principal heads, which are:—1st, the action of nitric acid on iodine; 2nd, the action of sulphuric acid on iodic acid; 3rd, the study of two new oxygenous combinations of iodine.

I. ACTION OF NITRIC ACID ON IODINE.

Nitric acid, in acting on iodine, presents variations no less great than those which it exerts, according to its different states of hydratation with respect to the metals. The presence of nitrous acid likewise modifies this action in the most remarkable manner. Thus, nitric acid with $4\frac{1}{2}$ equivalents of water does not oxidise iodine, and merely dissolves it by heat; nitric acid with 3 equivalents

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* *Comptes Rendus*, No. 23, June 3, 1844.

of water converts it into iodic acid; nitric acid with 1 or 2 equivalents of water brings the iodine to a new degree of oxidation, inferior to all those which have hitherto been discovered, and leads to the preparation of a peculiar acid whose formula is IO^4 hyporodic acid.

The influence of nitrous acid is exerted on all the three hydrates which have just been mentioned; but this influence is especially manifest with regard to iodic acid. Whilst nitric acid with $4\frac{1}{2}$ equivalents of water dissolves iodic acid very well, the same acid, mixed with a small quantity of nitrous acid, alters the iodic acid, reduces it, and gives rise to a deposit of iodine.

These different phenomena will explain to those who are occupied with the action of nitric acid on iodine, the singularity of the phenomena which have been observed.

11. ACTION OF SULPHURIC ACID ON IODIC ACID.

Gay-Lussac, in tracing the general history of iodine, confines himself to saying, that sulphuric acid decomposes iodic acid into iodine and oxygen. Sir H. Davy, pursuing the same study, has noticed a yellow compound which he regards as a combination of the two acids. Serullas in vain endeavored to produce the combination noticed by Davy, and considered himself authorised in denying its existence.

In the examination of this apparently very simple reaction, which has been controverted, nevertheless, as is known by some eminent chemists, I have arrived at recognising the production of a dozen new, solid, crystalline compounds, of a perfectly determinate but very strange constitution. The following are the phenomena observed in the action of sulphuric acid on iodic acid, and which may very easily be followed out in a small glass flask with the aid of a spirit-lamp.

At a temperature very near its boiling point, sulphuric acid dissolves iodic acid in the proportion of one-fifth of its weight. If, after the solution of the iodic acid, the heat be continued, a disengagement of very pure oxygen takes place without any mixture of iodine. From the time when the oxygen is disengaged the liquor is colored of a deep yellow, and this tint increases with the production of the gas. Afterwards, by continuing the action of heat, the sulphuric acid becomes greenish; the iodine then appears, and accompanies the disengagement of oxygen to the end.

By stopping, in the course of the reaction, at different phases which are perfectly distinct, there may be separated from the sulphuric acid:—

1. Several combinations of sulphuric and iodic acid.

2. Combinations formed by the union of the three acids—iodic, hypoiodic, and sulphuric.

3. Combinations of hypoiodic and sulphuric acids.

4. Combinations of sulphuric acid and of a peculiar acid of iodine still less oxidised than hypoiodic acid, which is represented in its formula by $I^5 O^{19}$, and which is called *subhypoiodic acid.*

All these combinations have special conditions of existence, out of which they are destroyed with great rapidity. Thus, they are stable only in perfectly-dried air, or else in concentrated sulphuric acid. These are circumstances which throw great difficulties into the study of these compounds; if it be added that they are all formed only in contact with boiling sulphuric acid and iodic acid, the care necessary for arresting the reaction in time, and for separating these different products from one another will be understood.

Nevertheless, a dozen different compounds have been isolated and analysed with accuracy; a still greater number of them are certainly produced. I should also add that, from the mode of separation employed, the insoluble and crystallisable products alone were analysed. If there exist soluble combinations of sulphuric acid, with IO^5, IO^4, I^5, O^{19}, or even with other oxygenous combinations of iodine, they must have escaped me.

But the products which have been described will suffice, I hope, for establishing the point of view to which I am attached.

It is sufficient to glance at the formulæ which represent these compounds to be struck with the novelty of their appearance.

To what order of combinations must these peculiar compounds be referred?

How must their composition be represented?

What idea must be formed of their production?

These are questions which flow from the study of these different products, for they especially affect theoretical and classical points of view of chemistry.

These combinations, represented in their formula by the association of two or three acids, do not appear at this moment susceptible of any other interpretation.

These are complex products which result from several acids, combined together, placed in connection with one another, in an antagonism as complete, in an electrical opposition, if it be wished so to speak—as complete as in the case of an alkaline oxide in presence of an energetic acid.

This certain and varied union of several acid principles marks precisely the novel character of the products which result from the action of sulphuric acid on iodic acid.

Some doubts may still be retained as to the real combination of the mineral acids with each other. The combination of chromic and sulphuric acids, noticed by Gay-Lussac, is, indeed, disputed by several skilful chemists. The products which result from the union of sulphuric acid with the nitric and nitrous compounds, are scarcely indicated. The analysis of one of them has been made with the view of a peculiar systematic idea. Compounds such as

$IO^5, HO + 3\ SO^3, HO$; $2\ IO^5 + IO^4 + SO^3, HO$; $IO^4 + 2\ SO^3, HO$; &c.,

leave no uncertainty.

It must be admitted that the mineral acids combine together to the number of 2 and 3, and in variable proportions; that these combinations, in the circumstances in which they are produced, possess the form, constitution, and stability of the products which are best defined.

This conclusion leads us to reflect on the antagonism—that is to say, on the reciprocal affinity of acids and bases. A different antagonism is here observed: these are acids which are added to other acids, forming regularly constituted combinations. Must we, for this reason, deny the antagonism of acids and bases? Certainly not. It must be recognised that the affinity which causes the association of acid principles with basic principles, is subordinate to conditions in which we have always operated, without exactly accounting for their influence. These are conditions of the medium and of the solvent. In such media as water and atmospheric air, the acids regularly combine with the bases, the acids repel the acids; the bases are displaced from them, and are mutually separated. In such a medium as sulphuric acid, the conditions of affinity are changed; the acids are superposed, added to one another, and are grouped in complex products.

M. Pelouze, by employing alcohol as a solvent, instead of water, has shown the disturbance effected in the ordinary relations of affinity: acetic acid is displaced by carbonic acid in an alcoholic solution. By separating water from a great number of reactions, H. Rose showed what curious associations might be produced. We have ourselves been able to condense anhydrous sulphuric acid over carbonate of potassa, and in this contact to liquify the acid by heat, to distil for one hour without disengaging carbonic acid.

It is therefore necessary to observe chemical affinity in the most varied conditions, and to account for all the circumstances which accompany it.

The different media in which we operate, sometimes admit of exceptions in the general arrangements and in the rules which they establish; it sometimes happens that, in determining special affinities, the influences of the medium find limits, or contrary forces overcome and efface them. Thus, although the presence of water brings about the union of acids and bases, salts exist in which water separates the acids from these bases. It is thus with certain nitrates of mercury. The influence of water may likewise be wanting with respect to the acids of which it causes, in the general way, the separation or reciprocal displacement. It seems to us that this fact is observed in the combinations designated under the name of *emetic* or *alum*. The principle of association of the acids with each other, so manifest when we act in an acid medium, out of contact with the damp air, with sulphuric and iodic acids for example, is also followed in the emetics and the alums, in water, and notwithstanding the influence of water. It is thus understood that bitartrate of potassa unites with boracic, arsenious and arsenic acids, as well as with the oxides of chrome, iron (sesquioxide), and antimony, which it would be much more rational always to regard as acids.

As a very general consequence of the study of the compounds which result from the action of sulphuric on iodic acid, it may be concluded that the acids have no less tendency to combine with one another than acids with bases, and perhaps than bases with each other. This tendency is especially manifested in peculiar circumstances of atmosphere and medium, but it perseveres even in a solvent which may be considered opposed to such alliances.

We find in this tendency the explanation of certain compounds, such as the emetics and alums, which have hitherto presented a sort of anomaly of constitution. By uniformly admitting, in alumina, peroxide of iron and oxides of the same formula, $M^2\ O^3$, the part of an acid; by placing the combinations which they form with the acids side by side with the compounds which sulphuric and iodic or hypoiodic acids produce together, we think that the general intelligence and history of these combinations would be facilitated.

III. STUDY OF TWO NEW OXYGENOUS COMBINATIONS OF IODINE.

The study of two new oxygenous combinations of iodine, which are produced by the action of nitric acid on iodine, and of sulphuric acid on iodic acid, create new terms

of resemblance between the series of chlorine and the series of iodine.

These two acids, which are represented, one by IO^4, the other by $I^5 O^{19}$, are ranked with hypochloric acid, $Cl O^4$; chloroehloric acid, $Cl^3 O^{15}$; and chloroperchlorie aeid, $Cl^3 O^{17}$. Subhypoiodic acid presented to me, in its study, advantages to which I attach some value. It is obtained, indeed, in several different ways: it is handled and purified without difficulty, and the analytical method, by means of which its composition is determined, is susceptible of great accuracy. The polyatomic mineral acids, such as $Cl^3 O^{13}$, and $Cl^3 O^{17}$, concerning which I have already had occasion to present peculiar eonsiderations, will thus acquire a new degree of evidence.

ON SEVERAL NEW SALTS FORMED BY THE REACTION OF SULPHUROUS AND NITROUS ACIDS ON ALKALINE BASES.*

BY M. E. FREMY.

In a work on the metallic acids formed by osmium, with which I have long been occupied, and whose results I will shortly communicate to the Academy, I have had occasion to examine the action of sulphurous acid on salts, to which I have given the name of *osmites*. I have ascertained that the osmites may be combined with sulphurous acid, and form new compounds in which the properties of sulphuric acid appear disguised. I intend to extend these reactions, which will be described in detail in my memoir on osmium, to salts resembling the osmites, such as the nitrites, phosphites, &c.

I have now the honor of announcing to the Academy that when a current of sulphurous acid and nitrous or hyponitric acid is passed into a great excess of potassa, the liquor immediately deposits long silk needles of a salt of potassa, which is almost insoluble in cold water. This salt contains a new acid, which is formed of oxygen, sulphur, and nitrogen. It undergoes by heat a characteristic decomposition, for it is converted into sulphate of potassa, ammonia and a volatile ammoniacal salt.

The salts of soda and ammonia may be prepared directly like the salt of potassa, are soluble in cold water, and readily crystallise. Their solution, made cold, is neutral, and is not precipitated by the salts of baryta and lead; when it is boiled, it becomes powerfully acid, and presents the reactions of sulphuric acid; the liquor contains an ammoniacal salt.

I think that the preceding facts sufficiently characterise the new salts, which are formed in the reaction of sulphurous and nitrous acids on bases. These bodies will evidently be placed side by side, with the nitro-sulphate of M. Pelouze. I have ascertained that, by varying the proportions of sulphurous and nitrous acids, different salts may be obtained which are all remarkable for their stability and their beautiful crystalline forms.

My object in this communication is to take date for a work to which I have been accidentally led, and which I will continue when I have completed the investigations which I have undertaken concerning osmium.

* *Comptes Rendus*, No. 24, June 10, 1844.

ENERGIATYPE.—A NEW PHOTOGRAPHIC PROCESS.*

BY ROBERT HUNT.

While pursuing some investigations, with a view to determine the influence of the solar rays upon precipitation, I have been led to the discovery of a new photographic agent which can be employed in the preparation of paper, with a facility which no other sensitive process possesses. Being desirous of affording all the information I possibly can to those who are anxious to avail themselves of the advantages offered by photography, I solicit a little space in your columns for the purpose of publishing the particulars of this new process. All the photographic processes with which we are at present acquainted, sufficiently sensitive for the fixation of the images of the camera obscura, require the most careful and precise manipulation; consequently, those who are not accustomed to the niceties of experimental pursuits are frequently annoyed by failures. The following statement will at once show the exceeding simplicity of the new discovery.

Good letter-paper is first washed over with the following solution—

	DRACHMS
A saturated solution of succinic acid	2
Mucilage of gum arabic.....	½
Water.....	1½

When the paper is dry, it is washed over once with an argentine solution, consisting of one drachm of nitrate of silver to one ounce of distilled water. The paper is allowed to dry in the dark, and it is fit for use; it can be preserved in a portfolio, and at any time employed in the camera. This paper is a

* *Athenæum*, June 1, 1844.

pure white, and it retains its color, which is a great advantage. At present, I find it necessary to expose this prepared paper in the camera obscura for periods, varying with the quantity of sunshine, from two to eight minutes, although from some results which I have obtained, I am satisfied that by a nice adjustment of the proportions of the materials, a much shorter exposure will suffice. When the paper is removed from the camera, no trace of a picture is visible. We have then to mix together one drachm of a saturated solution of *sulphate of iron*, and two or three drachms of the *mucilage of gum arabic*. A wide flat brush saturated with this solution is now swept over the face of the paper rapidly and evenly. In a few seconds, the dormant images are seen to develope themselves, and with great rapidity a pleasing *negative* photographic picture is produced. The iron solution is to be washed off as soon as the best effect appears, this being done with a soft sponge and clean water. The drawing is then soaked for a short time in water, and may be permanently fixed, by being washed over with ammonia—or perhaps better, with a solution of the hyposulphite of soda, care being taken that the salt is afterwards well washed out of the paper. From the pictures thus produced, any number of others correct in position, and in light and shadow, may be produced, by using the same succinated papers in the ordinary way; from five to ten minutes in sunshine producing the desired effect.

The advantages which this process possesses over every other, must be, I think, apparent. The papers are prepared in the most simple manner, and may be kept ready by the tourist until required for use: they require no preparation previously to their being placed in the camera, and they can be preserved until a convenient opportunity offers for bringing out the picture, which is done in the most simple manner, with a material which can be anywhere procured.

Anxious to give the public the advantage of this process during the beautiful weather of the present season, I have not waited to perfect the manipulatory details which are necessary for the production of portraits. It is sufficient, however, to say, that experiment has satisfied me of its applicability for this purpose.

Prismatic examination has proved that the rays effecting this chemical change are those which I have elsewhere shown to be perfectly independent of solar light or heat. I therefore propose to distinguish this process by a name which has a general rather than a particular application. Regarding all photographic phenomena as due to the principle ENERGIA, I would nevertheless wish to distinguish this very interesting process as the ENERGIATYPE.

I inclose you a few specimens of the results already obtained. The exceeding sensibility of the Energiatype is best shown by an attempt to copy engravings or leaves by it. The three specimens I inclose were produced by an exposure of considerably less than one second.

In No. 869 of the *Athenæum*, Mr. Hunt adds the following to the above letter:—

Hearing from numerous persons, who have tried the Energiatype process, of little annoyances, and in some cases of total failure, from some little manipulatory details not having been attended to, I must trespass, which I will do as briefly as possible, again on your columns.

In the first place, experience has suggested to me the advantage of adding to the solution of succinic acid and gum, as previously given, 5 grains of common salt. This preserves the lights very clear, and, indeed, improves the sensibility of the paper.

When the solution of the sulphate of iron is laid over the paper, it is requisite to keep disturbing it, by rapidly but lightly brushing it up; otherwise numerous little black specks form, which destroy the photograph. If, as sometimes happens, the surface of the picture blackens all over, it must not be concluded that the drawing is destroyed. The whole of this superficial blackness may be removed by immediately washing with a wet sponge. If the lights become in any way discolored, a little exceedingly diluted hydrochloric (muriatic) acid will restore them to their proper degree of whiteness; but care must be taken that the acid is speedily washed off, or the shadows will suffer.

When, from the shortness of the exposure, the image developes itself slowly or imperfectly, a slight degree of warmth brings out the picture with rapidity and force. Holding the paper at a short distance from the fire is the best mode of operating.

With these few additional directions, I believe but very little difficulty will be experienced, and I am satisfied that a little practice is alone required to render the Energiatype at once the most useful and beautiful of the Photographic processes on paper.

Falmouth, June 15th, 1844.

ON SOME RECENT RESEARCHES IN ELECTRICAL DECOMPOSITION.*

BY DR. MILLER, OF KING'S COLLEGE.

The lecturer, after showing by experiments that liquids when conveying the current are capable of extricating heat and inducing magnetism, and in these respects resembling solid conductors, proceeded to state that they differ from solids in the motion which their particles visibly exhibit; he asserted that most liquid bodies capable of transmitting the current consist of two or more chemical elements in combination, and that when subjected to the influence of a voltaïc battery they are decomposed; one portion of the elements accumulating at one pole of the battery, whilst the other portion collects at the opposite pole.

Water, he remarked, had always been considered one of the substances most easily thus decomposed; yet he showed that a spark may be obtained under water from two charcoal points forming the poles of a battery, of nearly as great brilliancy as that produced by bringing them in contact in air, which is admitted to be an extremely bad conductor; he also interposed at one point of the circuit a small quantity of distilled water, and showed that no electricity passed; on adding a solution of sulphate of soda to the distilled water, immediate decomposition ensued, and abundance of gas was extricated, an experiment from which he inferred that the presence of a little saline matter confers conducting power upon the water.

After recalling attention to the discovery of Dr. Faraday, that the power measured at one point is a measure of the quantity capable of being decomposed at any point in the same circuit, he stated, that when saline solutions were electrolysed, an apparent exception to this law was observed, and the current appeared in this case to have twice the power; so that a proportion of the salt was decomposed, and at the same time gases from the decomposition of an equivalent quantity of water were set free, whilst a voltameter included in the circuit only indicated sufficient electricity to decompose either the salt or the water, but not both.

This apparent paradox he explained by stating that the salt alone is in any case decomposed, and that the decomposition of the water is an accidental circumstance.

All salts, he said, might be considered as composed of a metal, or something tantamount to a metal, in combination with a substance or group of substances possessed of equal but opposite electric power (in contradistinction to the common notion that they consist of an acid and a base in chemical union). When subjected to the decomposing action of the battery, the metal, he said, appeared at one pole, while the whole remaining elements were transferred to the opposite pole; when the metal, like potassium, was capable of decomposing water, at ordinary temperatures, gas was given off, consisting of pure hydrogen, an oxide of metal was formed, while at the other pole oxygen was given off from its separation from the bodies in combination with which it was transferred under the influence of the current, at the same time an equivalent of acid was set free; when, on the contrary, the metal, like lead or copper, was not capable of decomposing water, no hydrogen was extricated, but the metal itself was deposited in the solid form. Experiments were shown in proof of this assertion, the salts being in some cases dissolved in water, in others melted by heat alone; when melted nitrate of silver, for instance, was thus treated, the metallic silver was obtained in beautiful crystals.

After adverting to the value of the voltaic battery as a powerful means of investigating the molecular grouping of compound bodies, and aiding in the examination of disputed points in theoretical chemistry, the lecturer concluded by describing some curious results obtained relative to the transfer of the bodies disengaged under the influence of the current, and by stating that, contrary to the usually received opinion, such transfer did not take place in equivalent proportions in opposite directions; but that some substances, on the contrary, did not appear capable of transfer at all; among this number was copper, and he referred to this cause the impoverishment of the solution around the electrotype plate where the process is long continued.

* Royal Institution.—*Athenæum.*

ON THE COMBINATIONS OF TWO NEW ALKALINE BASES CONTAINING PLATINUM.*

BY M. JULES REISET.

I have already had the honor of calling the attention of the Academy to (*Comptes Rendus*, t. x., p. 871, and xi., 711) some compounds of which I now present a more complete study.

I have shown that protochloride of platinum and ammonia gives rise to a well crystallised body, whose formula is

$$N^2 H^6 Pt Cl + HO\dagger$$

* *Comptes Rendus*, No. 24, June 10, 1844.

† $N^2 H^6 = 2 NH^3$.

This body presents a composition which much resembles a peculiar series of combinations of platinum discovered by M. Gros. It may, indeed, aid in reproducing them; but it likewise leads to two series of very distinct salts, which have occupied me solely. These investigations remain thus beyond those which have been published by M. Gros, and which, besides, he desired to pursue.

With a salt of silver, the chloride $N^2 H^6 Pt Cl$, gives a precipitate of chloride of silver; the liquor, filtered and evaporated, allows a new salt to crystallise, which does not contain chlorine :—

$$N^2 H^6 Pt Cl + AgOA = ClAg + N^2 H^6 Pt O,A.$$

Thus we obtain :—

The sulphate $N^2 H^6 Pt O, SO^3$

The nitrate $N^2 H^6 Pt O, NO^5$

These salts are neutral, without action on vegetable colors, and crystallise with the greatest facility.

The base of these salts is easily isolated by treating the sulphate $N^2 H^6 Pt O, SO^3$, in a suitable manner with baryta water. On the addition of the first drops of baryta water, a precipitate of sulphate of baryta is obtained, and the liquor becomes powerfully alkaline, without any perceptible disengagement of ammonia, even when boiled for a long time: the ley, evaporated out of contact with the air, and placed in a dry vacuum, assumes the form of a mass of crystalline needles, of an opaque white after complete desiccation.

In this state, the isolated base contains one equivalent of water, which can be removed from it only by combining it with the acids.

$N^2 H^6 Pt, O, HO$, the base isolated and dried *in vacuo*.

This base is powerfully alkaline and caustic; it may, to a certain extent, be compared with soda and potassa; like these two alkalis, it is deliquescent, and rapidly combines with carbonic acid, forming a carbonate, $N^2 H^6 Pt O, CO^2 HO$, and a bicarbonate $N^2 H^6 Pt O, 2 (CO^2) HO$, less soluble than the neutral carbonate; it displaces ammonia from its combinations, and may be employed, like potassa, in Trommaer's process, for detecting a trace of grape-sugar with oxide of copper.

The action of heat on the isolated base is very remarkable: at 230° F., it fuses, swells up considerably, losing the elements of an equivalent of oxide of ammonium, $NH^3 HO$, and becomes $NH^3 Pt O$, a grayish mass, entirely insoluble in water and ammonia, giving with acids insoluble and detonating compounds.

Heated in a single point to 392° F., this body becomes incandescent, and continues to burn beyond the focus, making a noise similar to that produced by nitre on red-hot coals. This phenomenon occurs only in contact with the air; the ammonia then meets with oxygen, and burns by means of a *catalytic body*, metallic platinum, as porous as the froth of soap.

In close vessels, or *in vacuo*, the base heated to 392 degrees does not become incandescent; it is tranquilly decomposed, yielding water, ammonia and metallic platinum. The gas disengaged is pure nitrogen.

During one of the phases of this decomposition, there is no doubt formed a nitroguret of platinum which afterwards gives the nitrogen. The following very well represents the reaction :—

$$3 (NH^3 Pt O) = Pt^3 N + H^3 O^3 + N^2 H^6.$$

The quantity of nitrogen collected is perfectly in harmony with this mode of decomposition, which demonstrates the existence of the nitroguret of platinum $N Pt^3$, corresponding to ammonia NH^3; but it is very unstable, and I have not succeeded in my endeavors to isolate it.

The iodide and bromide of the base are easily prepared by double decomposition, with the sulphate, $N^2 H^6 Pt O, SO^3$, and iodide or bromide of barium.

The iodide, $N^2 H^6 Pt I$, crystallises in cubes; its boiling solution disengages 1 equivalent of ammonia NH^3, and there is deposited at the same time a yellow powder $NH^3 Pt I$, corresponding to the salt of Magnus.

The bromide, $N^2 H^6 Pt Br$, crystallises in cubes, and does not undergo, by boiling, the same decomposition as the iodide.

I tried to combine hydrocyanic acid directly with the base; I always obtained hydrocyanate of ammonia and a crystalline white precipitate, $NH^3 Pt Cy$. This salt takes its place by the side of the salt of Magnus, which contains only one equivalent of ammonia combined with the oxide of platinum.

The sulphate and nitrate of this second series are obtained by boiling, with a salt of silver, the iodide $NH^3 Pt I$. The reaction is then very clear :—

$$NH^3 Pt I + Ag OA = IAg + NH^3 Pt OA.$$

These salts crystallise less easily than those of the first series; they powerfully redden tincture of litmus.

The nitrate $NH^3 Pt ONO^5$ does not contain water.

The sulphate retains 1 equivalent, which cannot be removed from it: $NH^3 Pt O, SO^3 HO$.

A few drops of hydrochloric acid or of a chloride, poured into a salt of this series,

produce in it, in a few moments, a crystalline precipitate of a fine yellow, isomeric with the salt of Magnus, NH^3 Pt Cl, and which gives, like it, when dissolved in ammonia, crystals of N^2 H^6 Pt Cl.

The green salt of Magnus, insoluble in water, may be converted into its yellow isomeric modification, soluble in boiling water. Indeed, this green salt dissolves in a long time in a concentrated and boiling solution of nitrate or sulphate of ammonia; by cooling, beautiful yellow bracteæ are deposited, which are of exactly the same composition as the green salt of Magnus, NH^3 Pt Cl.

It will be understood how many new reactions it will be possible to obtain with bodies so stable and so easily prepared. I have already studied two interesting combinations which bichloride of platinum and the chloride N^2 H^6 Pt Cl may give.

By pouring bichloride of platinum into a solution of the chloride N^2 H^6 Pt Cl in excess, an abundant precipitate of an olive green is obtained. In this case a single equivalent of bichloride of platinum is united with 2 equivalents of chloride N^2 H^6 Pt Cl, and the formula of this green precipitate is :—

Pt Cl^2, 2 (N^2 H^6 Pt Cl). The formula of the tripoli-red salt is Pt Cl^2, N^2 H^6 Pt Cl.

First Series.

N^2 H^6 Pt O, HO, the isolated base.
N^2 H^6 Pt O, SO^3, sulphate.
N^2 H^6 Pt O, NO^5, nitrate.
N^2 H^6 Pt O, CO^2 HO, carbonate.
N^2 H^6 Pt O, 2 (CO^2) HO, bicarbonate.
N^2 H^6 Pt O, Cl + HO, chloride.
N^2 H^6 Pt O, Br, bromide.
N^2 H^6 Pt I, iodide.
N^2 H^6 Pt, Cl + Pt Cl^2, red double salt.
2 (N^2 H^6 Pt, Cl) + Pt Cl^2, green double salt.

Second Series.

NH^3 Pt O, obtained by heating N^2 H^6 Pt O, HO.
NH^3 Pt O, NO^5, nitrate.
NH^3 Pt O, SO^3, sulphate.
NH^3 Pt I, iodide.
NH^3 Pt, Cy, Cyanide.
NH^3 Pt Cl, chloride; green salt of Magnus, and its yellow isomeric modification.

With the exception of the cyanide and NH^3 Pt O, obtained by heating to 230° F., the base N^2 H^6 Pt O, HO, all the salts of the second series dissolve in ammonia, and reproduce those of the first series.

In like manner, by heating in a suitable manner certain salts of the first series, the corresponding salts of the second series are produced. Thus, at 482° F., the chloride N^2 H^6 Pt Cl loses 1 equivalent of ammonia NH^3, and is converted into a yellow powder isomeric with the salt of Magnus, NH^3 Pt Cl.

The two series which have just been described establish, in a certain manner, the existence of two new bases which contain platinum. Each of these bases has been subjected to tests which leave no doubt concerning their alkalinity, and the permanent association of all the elements which constitute them. In one of them, N^2 H^6 Pt O, this alkalinity exceeds in energy oxide of platinum, and even oxide of ammonium itself; it is almost equal to potassa. What idea can be formed of bases thus constituted?

It is impossible here to find in ammonia a part rendering it similar to water, according to the theory applied by Dr. Kane to the principal combinations of the metallic oxides with ammonia. Berzelius supposes that the acid is combined with the oxide of ammonium, and that this salt is afterwards intimately combined with a very peculiar combination of platinum, which he calls *copule*. He thus represents the sulphate of this base by NH^3 HO SO^3 + $\underbrace{NH^2 Pt}$.
copule.

Without pretending to fix in a definitive manner the constitution of these different compounds, it seems to us that it may be accounted for in a most simple manner, by admitting that the ammonia intimately combines with the oxide of platinum to form two peculiar bases. This combination, in the case of platinum, presents a remarkable fixity; with the other metallic oxides, on the contrary, ammonia generally gives unstable products, and remains combined only under the influence of energetic acids. We can scarcely comprehend with this fact of association, that 1 or 2 equivalents of ammonia, and sometimes more may be added to the same oxide, constituting bases. It is absolutely thus that water, in uniting with the oxides, may form bases different from the oxide produced by the simple union of the metal with oxygen.

In his important work on free and combined iodic acid (*Annales de Chimie et de Physique*, 3rd série, t. ix.), M. Millon has developed this point of view as regards the oxides of calcium, magnesium and copper, and it seems to us that this idea should be completely applied to the ammoniacal combinations.

Thus, in being grouped with water, with ammonia, with ammonia and water, and sometimes with itself, an oxide may form the following bases, capable of saturating a single equivalent of acid A :—

$NH^3\,MO$, $NH^3\,HO$, $NH^3\,Pt\,O$;

$N^2\,H^6\,MO$, $N^2\,H^6\,Pt\,O$, $N^2\,H^6\,Cu\,O$;

$3\,(NH^3)\,Ni\,O4\,HO + Cr\,O^3$ ammoniacal chromate of nickel analysed by MM. Melaguti and Sarzeau.

$CaO\,HO + IO^5$, iodate of lime.

$Mg\,O4\,HO + IO^5$, iodate of magnesia.

$3Mg\,O + 3IO^5$, teriodate of magnesia corresponding to the teriodate of potassa.

$CuOHO + IO^5$, iodate of copper, first form.

$3\,CuO + IO^5$, iodate of copper, second form.

$6\,CuO + IO^5$, iodate of copper, third form.

A more complete study of the ammoniacal combinations, and of the different states of hydratation of the metallic oxides, will certainly lead to reducing the considerable number of bases which this mode of view presents at first sight.

ON THE REDUCTION OF THE MAGNETIC ORES OF SAMAKOFF, TURKEY.*

BY MR. W. FAIRBAIRN.

He commenced by reviewing the few attempts which had been made towards improving the methods of treating the richer iron ores both of England and of foreign countries; the great English iron makers having restricted themselves to using the lean carbonates of iron, on account of the facilities they offered for working; the great advantages which might have resulted both in the quantity and quality of the metal produced from rich ore have been thus neglected.

It is stated that Mr. Ohanes Dadian, an active and enterprising Armenian, in the service of the Sublime Porte, brought to this country specimens of magnetic iron ore, and of bituminous coal found in the district of Samakoff, in Turkey. He had them analysed at Paris and in England, and found that the ore was nearly a pure oxide of iron, containing about 63 per cent. of metal, that it was free from sulphur, arsenic, and other deleterious matters, and that there was mixed with it about 12 per cent. of silicious earth.

The ore was described as being found in the form of a fine sand, covering extensive plains, where it had been deposited to the depth of several feet, probably by the action of water on the mountains around, where a similar ore existed in considerable masses.

In consequence of the favorable report of the assayers, and by the advice of Mr. Fairbairn, Mr. Ohanes Dadian determined to persevere in his projects, and his attention being directed to the process invented by Mr. Clay, for producing malleable iron direct from the ore, as described in a paper read at the Institution of Civil Engineers, Feb. 14th, 1843, he secured that gentleman's services to conduct some experiments, and subsequently engaged him to proceed to Turkey, to prosecute the working of the iron ore on an extensive scale, Mr. Clay's report, and that of Mr. Hague, were fully given; they contained details of the various ingenious modes employed to work the ore, which, being in the state of fine sand, either fell unmelted through the fuel into the bottom of the furnace, or was blown out of the top by the force of the blast. At length Mr. Clay, thinking that if the ore could be deoxidised by a previous operation, it would be in a fitter state for fusion in the blast-furnace, submitted it to a partial process, as far as causing it to form into lumps; in that form it was easily fused, and produced cast iron of a peculiarly ductile fluid, and yet strong character, of which specimens were exhibited; the success of this plan was considered so complete, that the preparations were immediately commenced for erecting works in Turkey on a large scale.

* Institution of Civil Engineers, April 30, 1844.—*Athenæum.*

ON THE TORREFACTION OF ORGANIC BODIES.*

BY THE BARON DE REICHENBACH.

Water is the best solvent of assamar; it dissolves it in all quantities, and is separated from it only with great difficulty. I was not able to extract much of it from concentrated solutions under the pneumatic machine: I did not succeed, even at a moderate heat, in obtaining it dry. Exposed to the air in a concentrated state, it furnished, it is true, bubbles of gas before the temperature at which water boils; however, this was not due alone to the evaporation of the water, but there was, at the same time, a decomposition of the assamar. This effervescence scarcely lasted until the pale yellow color became darker; it has an agreeable odor; the bitter taste speedily diminishes, and soon entirely disappears. If the mixture be then treated by alcohol, little or no assamar is found in it; but it is replaced by a large quantity of that insoluble substance which gave the flocculent precipitate. Assamar is, therefore, decomposed before being dishydrated. I have

* *Annalen der Chemie und Pharmacie.*

never succeeded in obtaining more than a few drops in the anhydrous state; I accomplish this only by the most rapid desiccation, and this only at the expense of the decomposition of some small portions.

These circumstances render it always difficult to evaporate, in the open air, aqueous liquors containing assamar. If they be obtained, by evaporating spirituous solutions, the moment when the last alcohol is disengaged and when the water alone remains is the commencement of danger. Without great attention, the assamar becomes impure in a few seconds, and undergoes a partial decomposition. Bubbles are formed; the deepening of the color indicates the commencement of decomposition and the work is lost. Distillation in retorts on a sand-bath diminishes the danger; but the observation of the precise moment is then more difficult.

Spirit of wine of 0·83 slowly dissolves assamar without heat; but it readily dissolves it in a great quantity with the aid of heat.

Alcohol dissolves it in a smaller quantity and more slowly; but boiling augments its solubility. This combination is separated by ether, which precipitates a portion of assamar from the alcoholic solution, and which precipitates so much the more of it as the ether added is more anhydrous. But hydrated ether has a weaker action; it is so much the weaker as it contains more water. The latter, indeed, holds the assamar in solution. However, ether forms very little precipitate in the spirituous solutions.

Ether alone has no affinity for this body, and has no action on it.

The solutions of assamar do not act on the vegetable colors: it is a neutral body.

Its affinity for oxygen is evinced by the facility with which it burns with a flame by means of heat; but the red oxide of mercury and lead are not attacked at the boiling temperature by its aqueous solutions. It is the same with oxide of copper. Nitric acid decolours the liquor by boiling, without red vapors being formed; neither mucic nor oxalic acid is formed; without heat, it does not present any sensible action. Concentrated sulphuric acid blackens it without heat; when dilute, it does not exert the same action even by boiling. Bichromate of potassa has no action on it. Nitrate of silver is reduced. Sulphate of peroxide of iron undergoes no change cold; it is the same with chloride of platinum. Chloride of gold gives a blue-black precipitate. Sulphate of copper is not changed by boiling; it is worthy of remark, on the contrary, that acetate of copper gives by boiling an orange precipitate, and is consequently reduced to the state of peroxide. All these properties give the approximative measure of the affinity of assamar for oxygen.

The acetate and subacetate of lead do not produce any change in the pure solution of assamar. The latter forms, on the contrary, brown precipitates at the boiling temperature in the impure solution; but assamar itself takes no part in it.

The salt of tin is without action.

Hydrochloric acid does not produce any change. A current of gaseous chlorine has no sensible action; but, if the liquor impregnated with it be afterwards heated, it is decolored as by nitric acid; these phenomena require new investigations.

The positive bodies exert very little action on it: thus, ammonia has no action on it.

It is the same with cold and boiling potassa. It is the same with potassa cold and at the boiling temperature. If the assamar is impure, the alkalis render the color deeper; if it be heated, no ammoniacal odor is developed.

Lime water has no sensible action even at the boiling temperature. Impure assamar gives, at this temperature, brown precipitates, to which I shall recur in another memoir.

It is the same with baryta water. All these alkalis are not neutralised by assamar.

If the solution of assamar be heated for a short time with potassa, lime, or any other alkaline substance, the bitter taste disappears. Neutralisation by acids does not reëstablish it; the assamar is decomposed and destroyed, and cannot be regenerated.

The solution of silicate of soda does not give any precipitate.

It is the same with borax. Tincture of galls and fish size are also without action.

Yeast does not produce fermentation.

The knowledge of this series of properties enables us to undertake the examination of the process of preparation, and I now return to the peculiarities which it presents. We have a substance which, on one hand, is rebellious to affinities, and which, on the other hand, being of itself of a very unstable constitution, is easily decomposed in certain cases. Moreover, it cannot be crystallised, nor distilled, nor precipitated in any of the combinations hitherto tried; and, to increase the obstacles, it powerfully absorbs moisture from the air. It is, therefore, an unseizable body, and, finally, it is also observed that it is intimately united in the the products of torrefaction with other similar gummy bodies, its isolation is, therefore, surrounded with difficulties to an extent rare in chemistry.

But the obstacles do not end here. All the organic bodies which furnish assamar,

after torrefaction, contain small quantities of lime. I have made investigations on this subject, and I hope to find in sugar a body free from lime; but I have observed that it cannot be obtained without this mixture. Even the purest and most colorless candy always contained lime, in whatever manner I procured it. Carbonic, sulphuric, oxalic acids, &c., did not indicate its presence; but, by having recourse to combustion, I always obtained small quantities of ash, which, small as they were, did not the less interfere with its absolute purity. Small portions passed, without my being able to prevent it, into the alcoholic solution of assamar; and although their quantity was extremely small, I have never been able to free it completely of them, because the means of separation known were always incapable of attacking the last portions in this combination. The purest assamar which I have obtained always contained, therefore, like the purest gum and starch, a slight residue of lime, whose presence it is impossible not to perceive, although it amounts to less than $\frac{1}{10}$ per cent., and which has not been deficient even when I have not used lime for neutralising the solutions. I do not speak of the chloride of calcium, which is too often found in appreciable quantities in absolute alcohol, nor of the lime, of which traces are very often met with even in anhydrous ether, and which may spoil the most carefully made preparation, if attention be not paid to it.

I most frequently used wheat bread for the preparation of assamar; and I have baked expressly small loaves without salt. I cut it in slices and roasted it until it became of a black-brown, on hot plates, then I bruised it while still warm in a mortar. I then immediately treated it by alcohol, or else I followed a longer process, consisting in treating it first by water, evoporating the latter, redissolving in spirit of wine, concentrating, *de novo*, and immediately treating by alcohol in the manner above indicated. This latter process requires less alcohol but more spirit of wine. However, as the latter is more easily obtained in large quantities than the former, it is preferable in certain cases.

The operation may be commenced with weak spirit of wine instead of water, and we have then less to fear from foreign mixtures. If at the same time heat be employed, it dissolves much more assamar, but removes also a much greater quantity of foreign substances, a great part of which is immediately separated by cooling; the assamar remains in solution.

If the torrefaction be not carried far enough, little assamar is obtained. The best torrefaction is that when the torrified body has acquired the most powerful bitterness. This degree varies for the different substances, and it must be sought for in each case in particular. I have ordinarily found nitrogenous bodies richer in assamar; it is necessary to powerfully torrefy non-nitrogenous substances, such as starch and gum, and they have always furnished in a proportionally smaller quantity; but sugar, although containing no nitrogen, gives assamar in abundance. Ligneous fibre is a substance in which I have not been able to produce it by torrefaction; it did not furnish assamar at all, or if it gave traces of it, it was due to a slight mixture of other substances; but fibre itself, linen, and unsized paper, I have always found improper for its formation. We see then what difference bodies of the same quantitative and qualitative composition, with the most opposite principles, present in their mode of acting during torrefaction.

The color of impure assamar is, like that of all torrefied bodies, principally composed of two colors—of a dull brown and of the fine amber yellow which I regard as properly belonging to assamar. It appears of a gamboge yellow in milky precipitations. The experiments for decoloring them by animal charcoal have been unsuccessful, and when I obtained colorless filtered liquors, all bitterness had disappeared; the charcoal had, therefore, completely absorbed the assamar.

If we interrupt the distillation of the alcoholic solution of assamar, procured from saccharine substances, before they have been brought to the syrupy consistence, when, all being still fluid, they approach concentration; and when the liquors are allowed to cool slowly, they often become as turbid as when they are mixed with ether before distillation, a fine powder is precipitated; this is sugar, which adheres powerfully to the bottom of the vessel, and the supernatant liquor may be drawn off clear. It was held in solution by the assamar. The more anhydrous the alcohol employed, and the lower the temperature at which the solution is operated, the less sugar the liquor contains. Cold exerts a similar action on another unknown substance. I should observe that the bodies which require to be torrified under the pulverulent form, always furnish less assamar than those which undergo this treatment in the compact state. The powder of gum and starch always gives very little of it; ligneous fibre, under the form of sawdust, linen, or paper, furnishes none at all. I do not know whether the access of air, which appears injurious, with heat, to

the stability of assamar, prevents its formation, or whether it immediately destroys it.

The difficulty of obtaining andydrous assamar is extreme, because it is impossible to free it from water by heat without beginning to decompose it, and because there does not exist, or no other body has been found with which it might be obtained free from water or alcohol, or indeed combined with a determinable proportion of water. These are reasons which made me feel the inutility at present of an elementary analysis, and I think it inexecutable until we have succeeded in remedying, by new plans, one or other of these circumstances. It may be foreseen that a substance which has so many relations as this with daily life, will be the subject of numerous works, and that very soon more extended investigations will develop its properties in all directions. However, the principal question—the presence or absence of nitrogen in its intimate constitution—is already susceptible of precise solution; the reply is negative, and the reason is, that it may be as well furnished by non-nitrogenous as by nitrogenous bodies.

And now it remains only for me to say a few words concerning the practical interest of this substance. There is scarcely, with the exception of water, any body more generally diffused in human society than assamar. The savage who prepares his prey at the fire; the mendicant who bakes a potato, an ear of corn or an onion; the criminal in prison who eats a piece of bread with his water; all the civilised world, which has recourse to fire for the preparation of its roast meat, omlets, tarts, sugar, coffee and brown beer, daily swallow quantities of assamar; all the brown crusts, all the brown surfaces of meat, all articles burnt in sugar, such liquors as *krambamboli*, &c., all these substances are covered or impregnated with this body. It is especially to its slight bitterness that they are in a great measure indebted for their agreeable aroma. There is, therefore, nothing in the world of which all men, of all positions and of all times, have made more frequent use, and which is, consequently, more generally diffused, than this substance.

The greatest quantity is taken in coffee. Caffeïn itself is only very slightly bitter, and as it is found in only very small proportions ($\frac{1}{300}$ of the seeds), it performs only a very slight part in the bitterness of the decoction of the torrefied seed. It is known, that coffee has a more powerful bitter taste, as its torrefaction has been carried further. The bitterness of this drink, therefore, arises entirely from the assamar which torrefaction produces in it, and whose proportion can be regulated by a more or less torrefaction. Hence result some enlightenments for the pretended substitutes for coffee. Coffee is made of beet-roots, carrots, chiccory, eatable acorns, barley, figs, and other substances. They all acquire by torrefaction the sweet bitterness of assamar; roots owe it especially to the presence of their sugar, and seeds to their starch, gluten, and albumen: but only assamar, and not caffeïn, is produced in them: the latter and its properties are wanting. Their decoctions have an analogous taste, but never similar to that of coffee. Assamar is formed in great quantities in all the decoctions when the substances burn at the bottom of the vessels in which they are exposed to the fire. This too often occurs in the preparation of medicines. But a great heat is not always necessary for this effect; a moderate elevation of temperation suffices for giving rise to assamar. Various arts, dyeing, and the culinary art, furnish many examples of this. Crust of bread, as ordinarily sold by the baker, requires only an attentive examination for a delicate palate immediately to detect its slight bitterness. The fine products of the bakehouse, whose surface is not brown, but only yellow, are impregnated with assamar. I rasped some of these, whose color was scarcely pale yellow, and I tested the chippings by solvents; I found traces of assamar throughout; it is to a fine bitterness that these crusts owe their agreeable flavor. The bitterness of toast and water, which physicians give to feeble and convalescent invalids, arises solely from the assamar which the water dissolves. Burnt crusts of bread, baked flour, roasted chestnuts, the skin of baked potatoes, all kind of pie-crusts, every thing containing caramel, owe in a great measure to assamar their power of pleasing the taste.

Finally, another kind of culinary phenomena finds its explanation in the properties of assamar. Indeed, many baked and roasted products become flaccid and are spoiled. Bread and pie-crusts are, as is known, very agreeable so long as they are fresh and firm. This quality is lost in a few hours, and often much sooner in damp weather. Our housewives are inconsolable when the guests do not arrive in exact time, when the ice wafers *(oublies à glaces)* have become flaccid, when the burnt almonds stick instead of *rolling*, &c. I have stated above that, among the products of torrefaction, assamar is the only one that attracts moisture from the air and liquifies. Its hygrometric property is so powerful, that, as we have seen, it removes water even from spirits of wine, and the action is so rapid,

that caramel becomes viscid on its surface in a few minutes in a damp place. It is by this property that it acts in food. It attracts moisture from the air, communicates it to the substance in contact with it, deprives the pastry of its firmness, and renders it flaccid, flabby, and damp. If we wish to restore its qualities, we have only to put it in a place sufficientiy warm to drive off the moisture which has been absorbed, and it becomes as firm and as brittle as it was originally.

Does assamar exert any influence on the vital functions? Should attention in a medical and dietetical point of view be paid to it? This the sequel will show. Probably we shall see it, at the end of some time, constituting an industrial preparation, sold in commerce, and added, at will, to food, like any other aromatic: then the physiological question will soon take its rank and may be solved.

(To be continued.)

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE PRECIPITATION OF METALS BY OTHER METALS.*

BY M. BECQUEREL.

(*Continued from page* 315).

M. Capitaine (*Annales de Chimie et de Physique*, 3e Séric, t. ii., p. 126), had already shown that when a piece of zinc is plunged into a solution of protochloride of iron, as neutral as possible, the zinc, at the end of a short time, becomes magnetic; and that, by prolonging the operation for a sufficient time, at the ordinary temperature, it is covered with a thin mass of iron, which, in being precipitated, carried away zinc. He observed at the same time that bubbles of hydrogen were disengaged. In order to obtain iron free from zinc, he soldered a plate of zinc to a well-scoured plate of copper. The latter was covered with a layer of iron, which was easily detached by stecping the plate. The iron had a bluish-white color, possessing a metallic lustre, especially on the surface adhering to the copper. This expcriment resembles that which I have used for reducing the iron, and obtaining it in the same state; that is to say, in the state of crystals, tubercles, or plates. The differenee in the two methods consists in this: that, in mine, the copper and zinc pair is separated at its two free extremities by means of a porous diaphragm of clay, or other substance, separating the solution of iron from the solution of saline water, in which the zinc is steeped. This arrangement is more advantageous than that of M. Capitaine, because there is no fear that the iron, in being deposited on the copper, will be alloyed with the zinc, which is dissolved at the same time as the salt of iron is decomposed. This arrangement, therefore, allows of the iron being obtained perfectly pure.

However, the experiment of M. Capitaine has proved that, with a sheet of zinc, steeped in a solution of protochloride of iron, at the ordinary temperature, this salt is in time decomposed, and the iron obtained in the metallic state. But my solution of iron, as will be seen, in which the metal is in the state of protoxide, undergoes the same effects on the part of zinc, provided that we operate at a suitable temperature.

In my experiments on the electro-chemical treatment of metals, I had ascertained that, by raising the temperature of the solution of salt, at its maximum of concentration, to the temperature of 120° to 175° F., the electric current acquired an intensity capable of overcoming affinities which it could not at the ordinary temperature. This increasc in the electro-chemical action might be attributed to two causes: 1st., to a more powerful chemical reaction of the solution on the zinc; 2ndly, to a better conducting power on the part of the solution; for it is known that liquids, unlike solids, become better conductors in proportion as they arc heated, probably because heat, by diminishing the force of aggregation of their molecules, permits a current to act more effectually. In the following experiments I have taken into consideration this influence of heat for arriving at the immediate decomposition of some metallic salts, which could not take place with the reduction of the oxide, or the immediate separation of the chloride of the metal.

Let us apply this to the chlorides of cobalt and nickel, the results being the same as for other salts of these metals.

A few grammes of chloride of cobalt are dissolved in water, and the temperature is raised to boiling; an excess of very pure zinc, in powder, procured by the pulverisation of the metal heated to a suitable temperature, or else zinc obtained by the electro-chemical decomposition of a salt of that

* *Comptes Rendus*, No. 12, 1844.

metal is added, a brisk effervescence immediately takes place; in consequence of the reaction of the zinc on the water and the chloride, hydrogen is disengaged; the color of the zinc speedily changes from gray to black. A few minutes after, the solution, which has become perfectly colorless, is removed from the fire, washed and dried; there is collected at the bottom of the capsule the metallic powder, to which the extremity of a magnetised bar is presented; it is immediately attracted, and adheres to it. The chloride has, therefore, been decomposed, and the cobalt reduced to the metallic state. If the zinc is in filings, the parcels are covered with cobalt, and act individually on the magnetised needle. When the powder is very fine, the parts are likewise covered with cobalt. In order to remove the zinc, it is treated with acetic acid diluted with two or three times its bulk of water, at the ordinary temperature; for, with dilute sulphuric acid, the cobalt, on account of its state of fine division, is attacked, as is seen by the red coloration of the solution. The cobalt is then found in the state of a very finely divided black powder, taking the metallic lustre with difficulty, especially when the zinc is not pure. In an experiment in which I operated with 4 grammes of very dry chloride of cobalt, I obtained 1 gr. 26 of cobalt in powder. Theory indicates 1·36. It must also be mentioned that I have not observed in the washings all the precautions for avoiding loss of cobalt held in suspension in the liquid, since the acetic acid had dissolved a small quantity of it, which was not submitted to a new treatment. The same result with the sulphate, and, probably, with the acetate of cobalt. If, instead of operating with the powder of zinc, a cylinder of this metal be taken, it is found that the circular angle of the base is covered with small tubercles of cobalt, which may be removed with a cutting instrument; the surface even is cobaltised.

The salts of nickel, treated in the same manner, led to similar results. The nickel was obtained in the same time in the metallic state in an impalpable powder, attractable by the magnet, and possessing all the properties of nickel. I wished to ascertain to what point the process employed might be used for separating cobalt or nickel from iron, or from some other metals with which they are combined. I took 3 grammes of impure oxide of cobalt, extracted from the mine of cobaltiferous manganese of Nontron, and which contained small quantities of oxides of manganese and iron. After having dissolved this oxide in hydrochloric acid, and after having evaporated the excess of acid, I treated it by zinc, as above described. The cobalt and iron were reduced to the metallic state; then I added dilute acetic acid, which dissolved the iron and oxide of manganese, so that the cobalt was obtained pure, or mixed with a very small quantity of copper. In another experiment, in which the cobalt contained arsenic, the metallic powder was put into an apparatus for reducing, by means of hydrogen gas; the tube was heated, a stream of hydrogen being passed in to prevent the oxidation of the cobalt, and the arsenic was then volatilised; it was collected on the sides of the tube, so that the cobalt was perfectly pure. The process of reduction which I have just described might be turned to account in chemical analysis for readily obtaining cobalt and nickel in the metallic state, by separating them from several other metals with which they are combined in nature.

I will also add something to this process, which enables us to extract the zinc when we have only filings at command. When the latter are covered with cobalt or nickel, the reducing action of zinc becomes very feeble. In this case we decant; the zinc is bruised in an agate mortar, in order to clean the surfaces; the metallic powder is removed by washings, and we commence treating the solution of cobalt by cleaning the surfaces in the same manner. In this way is obtained, after having allowed the washing waters to settle, powder of cobalt or nickel, containing only very little zinc, which may be removed by means of dilute acetic acid. When we operate with a cylinder of zinc, which sometimes presents advantages, the immersed surface is brushed from time to time, in order to remove all the pulverulent matter deposited. When the operation is terminated, the surface of the zinc is grated, to remove all the pulverulent portions of cobalt which could not be detached by the brush. For the experiment to succeed, the zinc must be as pure as possible, and especially free from arsenic and copper; if it contains iron, it will cause little inconvenience.

When we operate at about 176° F., and even lower, the action is less tumultuous. The cobalt is not so finely divided; thus, small tubercles may be obtained which, under the burnisher, take the metallic lustre.

There is a very simple means of making zinc, in fine powder, act on a metallic solution, by making the electricity disengaged in the reaction aid powerfully. It is sufficient, for that purpose, to operate in a platinum vessel; in this case the zinc, platinum, and solution constitute a voltaic couple. The platinum being the negative pole, is in the state most favorable for not being attacked by the chlorides. It would be acted on only

if acid salts or solutions in potassa were employed. Except in this case, no alteration of the platinum need be feared. The sole difficulty would be that the deposited metal might adhere to the platinum.

CHAPTER II.

OF THE ADHERENT DEPOSITION OF METALS ON OTHER METALS.

In the foregoing chapter I have devoted myself to directly decomposing the salts of iron, cobalt, and nickel, by means of zinc, at a temperature near that of ebullition. I shall now show how we may cause to adhere on other metals not only the foregoing, iron, nickel, and cobalt, but also all the non-alkaline metals, with the exception of three or four, by plunging them, at a suitable temperature, into a metallic solution as neutral as possible. Electro-chemical gilding, or that by immersion of copper, is operated, as I have said, with alkaline solutions, or at least solutions possessing an alkaline reaction, the first at the ordinary, the second at the boiling, temperature. Gilding on other metals, besides some preparatory arrangements, as well as silvering, cobalting, and nickeling, likewise requires the employment of a solution of double cyanide or other alkaline solutions. Hence, the alkaline character of the solutions employed in the new processes is then well defined. The object which I propose to myself is to demonstrate that the same effects may be obtained, with the exception of the thickness which the pile alone can give, by immersions in neutral solutions, at the temperature of 140° to 212° F., according to the metals, sometimes with the aid of the contact of zinc with the precipitated metals. The adherence is so much the greater as the scouring is the more perfect, forasmuch as solidity can never be obtained with the "dead;" when scoured and polished, the object leaves the bath with a very brilliant aspect. This adherence is so great, that several metallic deposits sustain not only polishing with leather and English rouge, but also burnishing with a steel burnisher. The metallic deposit, moreover, is analogous to that of the gold in gilding by immersion; that is to say, the layer of gold is excessively fine, and it cannot be otherwise, since the reductive action of the precipitating metal ceases as soon as the surface is covered with the precipitated metal.

To preserve order in the explanation of the results which I now present, I will speak of each metal in particular, at least of those which give the best characterised effects, commencing with the electro-negative metals.

OF METALLIC DEPOSITS WITH ADHERENCE, OPERATED WITHOUT THE AID OF METALLIC CONTACT. DEPOSITION OF PLATINUM, OR PLATINISING.

Composition of the Liquor.—A solution of chloride of platinum, as neutral as possible, is taken, and a concentrated solution of potassa is poured in to effect its decomposition. The precipitate is washed, first with alcohol and water, then with alcohol to remove the excess of alkali without dissolving any double chloride or at least the mixture of double chloride, and platinate of potassa. The latter is then perfectly neutral, since its solution in distilled water does not change the color of litmus paper reddened by an acid. This solution, diluted with two or three times its bulk of water, serves for obtaining this platinate, by operating in the following manner. Its temperature is raised from 140° to 160° F. at the most, and the perfectly scoured objects are immersed therein. These objects at first become tarnished, and gradually clear, become brilliant, and the platinising is then effected. One minute at most is sufficient for this operation. The object is then dried in sawdust. The deposited platinum has a brilliant silvery white aspect, provided that the scouring has been complete. If the immersion were prolonged, the action of the solution would continue, slowly indeed, through the molecular insterstices. The layer of platinum first deposited would be detached here and there. By acting at 212° F. the action would be too energetic, the molecules would not aggregate, or at least would aggregate imperfectly. Below 140° F. the deposit would become less and less adherent, and would finally become pulverulent. Care must be taken, during the operation, not to touch the object with a piece of zinc, for it would immediately become black. It is indispensable to operate with a perfectly neutral solution, for, however little the alkaline reaction be manifested, all the effects described are no longer produced. A slight excess of acid, on the contrary, does not appear to interfere with the success of the operation; it is necessary to dry the objects with sawdust after they have been scoured. The following, I think, is the reason:—The copper, after having been scoured with the acids, is covered, notwithstanding the washings, with an excessively fine layer of oxide. By drying with sawdust, friction removes the fine layer of oxide, and the solution of platinum exerts the most efficacious action on the copper. The presence of protoxide of copper, which may be removed with acetic acid, must also be avoided.

Wishing to determine the quantity of platinum deposited per square decimetre, I made the two following experiments :—

Experiment I.—A square sheet of brass, of 45 millimetres broad; after having platinised it, it was put into a capsule with dilute nitric acid to dissolve the copper. There was then obtained an excessively fine pellicle of platinum, which, collected, dried, and weighed, gave 0 gr. ·0035, equivalent to 0 gr. ·0086 per square decimetre.

Experiment II.—A sheet of red copper, of fifty millimetres in length, and 23 in breadth, weighed, platinised and re-weighed, gave a difference of weight equal to 0 gr. ·002. The platinum being substituted for the copper in atomic proportion, we have, by representing by p and p' the weights of the copper lost and platinum deposited :—

$$p' - p = 2,$$
$$p' : p :: 98{\cdot}54 : 31{\cdot}71,$$

98·54 and 31·71 being the atomic weights of platinum and copper. From these two equations are deduced—

$$p' = 3.$$

Now, according to the experiments of M. D'Arcet, for determining the amount of gold in gilding by immersion, we have—

	With mercury.	Water gilding.
Maximum gilding ..	0·0353	0·421
Minimum gilding ..	0·0274	,,

It is therefore evident that, in the first experiment, the quantity of platinum deposited per square decimetre is, to the quantity of gold deposited in minimum gilding, as 86 : 274 ; that is to say, that there was at least three times less platinum than gold deposited, and still the platinum was found in an uniform and continuous layer ; and that in the second, this proportion is as 123 : 274 ; that is to say, that there was less than half as much platinum as gold deposited. I will remark that, in this experiment, the plate was dried with saw-dust.

The thickness of the deposit may also be increased, but we run the risk of diminishing the adherence. I would observe, besides, that the latter varies as well as the thickness of the layer, with the nature of the brass. It is for industry to discover the brasses which are best adapted for platinising.

Platinising, as practiced by M. de Ruolz with the alkaline solution of platinum, does not unite the required quality, thickness ; the first layer, the layer deposited in the first place, is tarnished—it adheres ; but the subsequent deposits are pulverulent, because the electro-chemical action employed does not combine the desired conditions for the molecules of platinum to aggregate with those already deposited. Now, as the solution of platinum, on account of its nature, is very dilute, it is necessary to employ a current of very feeble intensity for determining the aggregation of molecules ; for I formerly demonstrated that the more dilute a metallic solution is, the less intensity should a current have, for the metallic molecules to deposit on the negative electrode with adherence, or in such a manner as to crystallise.

When platinised copper, on leaving the bath, is exposed to the air without being dried, and consequently still wet with the solution of platinum, the latter is rapidly altered, and the platinised plates are covered with the most brilliant blue and violet colors.

I made some experiments, with the view of ascertaining to what point platinised copper was altered in water containing chloride of sodium, in the proportions required for forming sea water, which, as is known, rapidly alters copper. At the end of a short time, the platinised copper was covered with a very slight cloud of oxychloride of copper, announcing a feeble reaction of saline water on copper, through the interstices of the platinum. At the end of three or four days, the objects were withdrawn, and still presented the lustre of platinum.

Maillechort platinises perfectly well, and even takes a very fine polish. Iron is not covered with platinum without a similar preparation. I employed platinising with advantage on medals and bas-reliefs in red copper, obtained by galvanic processes, in order to give them, by depositing on their surface layers of peroxide of lead of different degrees of thickness, all the desirable colors of bronze, and to produce even piquant effects of color which it would be difficult to obtain by any other process. This kind of bronzing has the advantage over every other kind of painting, that it deposits only an excessively fine layer of oxide, which cannot alter the fineness of the strokes of the figures.

The Academy will be able to appreciate the value of my assertions, by glancing on the various objects, products of galvanoplastic, which I have the honor of presenting to it.

Finally, I will observe, that since the platinised copper is covered, when it is moistened in the air, with beautiful colors which are obtained in the first few moments, when they are submitted to the action of a solution of lead by means of potassa and the battery, I will observe that the beautiful colors which afterwards appear under the influence of the pile, are probably due, as I have already advanced, to the reaction of protoxide of platinum, on the one part, on oxide of lead ; on the other, on oxide of copper.

APPLICATION OF PALLADIUM.

That which I have just said of platinum deposited on different metals, applies in every respect to palladium; that is to say, that to cover copper with this latter metal, a neutral double chloride of palladium and potassium is formed, containing an atomic proportion of each chloride, and we operate according to the same indications.

The object covered with palladium has the appearance of platinum, perhaps rather whiter, with a brilliancy comparable, to a certain extent, with that of silver. The quantity of palladium deposited is sensibly the same as that of platinum in the foregoing experiments. As this metal has very little affinity for oxygen, as it is susceptible of acquiring a very great lustre, and as the deposit is very thin, it might be employed in certain circumstances, although its price is very high. The objects which I now exhibit to the Academy will give an idea of the beauty of copper covered with palladium.

DEPOSIT OF IRIDIUM.

The same mode of operating as for the foregoing. The deposit of iridium appears similar to that of platinum with respect to the quantity of metal deposited, the color, and the lustre. However, the few pieces prepared appear to me to have a brilliant aspect verging on that of steel.

DEPOSIT OF RHODIUM.

Rhodium deposited on red copper or brass, according to the above directions, acts absolutely like platinum, and the other metals which accompany it: the results are absolutely the same. As to osmium, not having been able to procure a chloride of that metal, I have not been able to deposit it on copper; but analogy leads me to believe that it would be deposited like the other metals.

DEPOSITION OF GOLD, OR GILDING.

Hitherto the mode of experimenting above described, has not been able to produce nearly such good effects as those obtained with platinum, and the metals which accompany it.

EXTRACT OF A MEMOIR ON VEGETATION CONSIDERED IN A CHEMICAL POINT OF VIEW.

BY MM. F. C. CALVERT AND E. FERRAND.

Guided by the learned works which have lately thrown such light on the important question with which we are occupied, we proposed to ascertain, by chemical analysis, the change which the decomposition of the air contained in the plant undergoes, in the vegetables themselves, according to the organs in which the phenomena occur, and according to the circumstances which govern the modification of the phenomena.

In the first chapter of our memoir, we first discuss the value of the experiments made for proving the decomposition of carbonic acid by plants under the solar influence, and we show why we think that we are placed in conditions more favorable to this study, by not deviating from natural circumstances, that is to say, by studying the air contained in certain parts of the vegetable, the plant living and in full vegetation. We content ourselves with noticing here the principal objections which may be opposed to the investigations on this subject undertaken before us, and we will take as an example the experiments made by M. Theodore de Saussure, a celebrated chemist, who, as is well known, was occupied for a long time with this same question.

Thus we think that a vegetable, confined under bell-glasses, and, consequently in a limited atmosphere, is placed in circumstances essentially fatal to the appreciation of natural phenomena; the author, indeed, experimented on entire plants, and on leaves detached from trees, and on these two orders of investigation the following observations may be made:—

1. In the first case, under a bell-glass, over mercury, the entire plant at first, and more especially the layer of water, with which, for the sake of precaution, the metallic bath is covered, very soon saturates its limited atmosphere with moisture, and transpiration, having become impossible, does not impede without inconvenience a function of the organisation of plants.

2. Carbonic acid being an aliment indispensable to vegetables, how can it be conceived that they are nourished for some time in a medium in which, in very small quantity and not resupplied, this acid is immediately absorbed and decomposed by them in the sun?

3. In an expired air, if the nutritive element be wanting, on the one hand, and if, on the other hand, a disorganising principle, oxygen, be increased, the diseased state of the beings which respire it may readily be foreseen.

4. How clearly do the conditions of life and health appreciate this state of disease and suffering, often detected by the decoloration and fall of the leaves, and the non-maturation of the fruits?

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* *Journal de Pharmacie*, June, 1844.

5. In all the experiments thus made under bell-glasses, the absence of the soil has never been taken into account, and still the presence of certain salts is a necessary thing, an imperative want, as is seen every day in agriculture by the predilection of most crops for such and such mineral substances; doubtless, in the circumstance whose value we have just estimated, plants deprived of all kind of earth round their roots suffered little; but this sudden passage to this abnormal state could not but disturb the equilibrium of the vegetable functions, the harmony of the natural phenomena, and furnish causes of error.

The well-known experiment of M. de Saussure on the pervenche prove the complete absorption of carbonic acid; but the results of this operation, in establishing that a portion of the oxygen was retained, whilst an equivalent portion of nitrogen was produced by the plant, do not demonstrate, in our opinion, that all the carbonic acid was decomposed into carbon and oxygen.

To the experiments made on cut branches, leaves, &c., we may apply not only the foregoing objections, but another one in our opinion more serious;—that is, that the causes of considerable alteration must act so freely in the case of which we speak, that we think that there has been mistaken for a vital action a true chemical decomposition of the juices or tissues of plants.

M. de Saussure thus summed up on the leaves or dead parts of plants:—*

"Green plants exposed in atmospheric air to the successive action of day and night, make in it alternate inspirations and expirations of oxygen gas, mixed with carbonic acid gas. The oxygen gas which the plants inspire is not immediately assimilated in them; it is converted, in the inspiration, into carbonic acid; they decompose the latter in the act of expiration, and it is only by this decomposition, which is but partial, that they can assimilate the oxygen gas which serves them as an atmosphere."

The experiments whose results we have just read were made on the *Cactus opuntia*, placed under bell-glasses closed with mercury, and the author ascertained by these observations that oxygen was inspired in the night and expired in the day.† It is difficult to conceive how the author could conclude from these results the formation of carbonic acid at the expense of the carbon of a leaf said to be in full vigor; and it is still less explicable how this acid produced is retained in the state of gas in the very tissue of the vegetable (an opinion which this chemist owns, at p. 76 of the same work, not to have been demonstrated by direct experiments), and thus waits to be decomposed under the influence of the solar rays.

Is it not more probable that the oxygen absorbed by the leaves or branches is called into operation by its property as a supporter of combustion, and that it does not burn carbon, because this carbon is already combined, and, consequently, has no tendency to unite with oxygen; for this slow combustion, this destruction, could take place by the oxygen absorbed only inasmuch as light had not restored to these parts of plants all their vital faculties—all their power of resisting decomposition; and we will support our observations by an experiment of the same author on the *cactus*. We will add, however, that we cannot regard the phenomenon which is produced during life as similar to those which take place after death. Indeed, in the experiment of the disorganised cactus, carbon is no longer retained by a vital force susceptible of counterbalancing the combustible action of the oxygen on the carbon; carbonic acid is also disengaged without interruption.*

The experiments on fruits do not appear to us more favorable than those on leaves and stems to the explanation of the manner in which plants act on carbonic acid.

Indeed, M. Berard † gathered fruits and placed them in flasks exposed to the sun, and in darkness, and he remarked in all his experiments that the air was continually vitiated by the constant production of carbonic acid, whatever were the circumstances of light and the state of maturity of the fruits.

These results, furnished to the author even under the solar influence, do not enable us to understand an increase of weight, in despite of permanent loss of substance, and we should be led to apply to these works the same observations that the experiments already noticed have suggested to us, for it may be perfectly conceived if carbonic acid is disengaged even in the sun, it is because in organs which so readily enter into fermentation after being gathered, the vital force is no longer sufficiently powerful for preventing the acidification of the carbon.

The Memoir of M. Berard was partially

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* *Récherches Chimiques sur la Végétation*, p. 133.

† See, for further details, *Récherches Chimiques sur la Végétation*, by Theodore de Saussure: experiments of the night, p. 66, and those of the day, p. 82.

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* See page 219.

† See M. Berard's *Memoir on Fruits*. *Annales de Chimie et de Physique.*

refuted by MM.. Theodore de Saussure and Couverchell; and as the refutations were not based, to our knowledge at least, on experiments, we have undertaken on this subject a work which we hope will leave no doubt concerning the decomposition of carbonic acid in fruits under the solar influence.

The object of our first investigations was the examination of the air contained in the husks of the bladder-nut tree—experiments which indubitably destroy M. Berard's opinion that the pericarp of these husks is permeable to any extent to the external air; for, adds the author, the air which they contain is that of the atmosphere. To this conclusion we reply that this permeability of the husks to the air, exists only within very narrow limits, while the gas which fills these husks contains 3 per cent. of carbonic acid. It might be objected to us that this large proportion of carbonic acid gas is the effect of a production by the fruit itself; but in reply to this observation we would remark that, in our analyses, the quantity of oxygen was always in exact proportions, and always increasing with the decomposition of the carbonic acid in a given time, and under a determined intensity of light. We have observed, on the other hand, in the course of our operations, that the maximum of carbonic acid was found in fruits at night, and that, in order to obtain this maximum, from five o'clock in the afternoon till eleven o'clock at night, the increase was about $1\frac{1}{2}$ per cent., an increase which it is difficult to explain by the present theories. One of them, indeed, admits that the plant, under the solar influence, absorbs carbonic acid, which it immediately decomposes, and that in the dark the plants disengage the small quantities which they derive from the ground by their roots. The other theory also admits a constant absorption of carbonic acid which, during the day, is concentrated in the shade, and, during the night, is accumulated in all parts of the plant: thus, as in the foregoing theory, the decomposition commences only with the first rays of the sun. Finally, it regards the nocturnal expiration of the gas only as a very limited disengagement relating only to the more or less abundant transpiration of vegetables during the night.

By receiving the first theory, we cannot account, in a satisfactory manner, why the sum of carbonic acid found in the night in the husks, being represented by 3, loses 1·5 in the morning of the next day, and regains precisely 1·5 in the early part of the following night, so as to equal 3, the original quantity; for, according to this theory, it must be admitted that the passage of the acid into the parts of the plants is continual, the roots being always in the same condition of darkness; and this cannot be admitted, in our opinion, in the presence of our analyses in the day, whose proportions of carbonic acid diminish the ratio of the intensity of the solar light, and these quantities always remain in relation with those of our analyses of the night.

If we have allowed ourselves to advance that which we have just stated, it is because our experiments, repeated a great number of times, and at very distant periods, have always given uniform quantities of carbonic acid.

The second theory, attributing only to the direct rays of the sun the property of fixing the carbon, liberating the oxygen of the acid, seems to us to give no better explanation than the foregoing of the facts which we have observed, for it does not notice the decomposition of carbonic acid in the shade; and we may add, that the chemists who have studied this question do not appear to have taken account of the progress which the decomposition of carbon in vegetables follows, according to the length of time they are exposed, either to diffused light, or to the sun.

We think that plants absorb carbonic acid only during the night, and that the quantity, condensed, is greater than those which they are capable of decomposing next day, under the luminous rays. This absorption would take place in the following manner:—

The surrounding air, which contains, it is true, very small proportions of carbonic acid ($\frac{4}{10000}$ to $\frac{6}{10000}$), but quite sufficient for vegetation, as has been proved by interesting calculations, is incessantly removed round the leaves and stems, by the continual motion to which a number of physical causes excite them, and consequently presents to the plant, in a very short time, always fresh quantities of carbonic acid. Now, plants thus placed in a medium which presents to them an indispensable aliment, carbonic acid, absorb this gas, and neglect the other elements of the air; that is to say, in other terms, they condense it, without an absorption or an exhalation of these same elements being observed.

For the appreciation of the natural phenomena based on the decomposition of the carbonic acid, we commenced this part of our work by the examination of the air contained in fruits; and we thought that we should place ourselves in circumstances favorable to this study by adopting the following course:—

We took, for a type of our investigations, husks of the *Colutea arborescens*, which we

have said to be permeable to the air only within very narrow limits; and it was only with the mother plant, exposed to the open air in the *Jardin du Roi*, which we gathered immediately before being burst under mercury, in order to collect the gases under bell-glasses prepared for that purpose. This selection enabled us, moreover, to follow the influence of different periods of maturity on the nature of the gaseous mixtures which envelope the seeds; and finally, to appreciate properly the action of the light, according to its intensity.

We, therefore, chose dull days, and days perfectly illuminated by the sun. Then, in both cases, we collected the fruits at determined hours, and always the same; namely, at seven o'clock in the morning, at noon, at four o'clock, and at eleven o'clock at night.

The experiments commenced on the 10th of July, and were continued until the end of September.

The husks of colutea require about a month to arrive at maturity, and we took them in the three most sensible conditions of their period of growth, namely—

1. Those which have begun to be developed for a week at most, we will call *young*.

2. Those which after fifteen days or three weeks have attained their full size, but whose pericarp and grain are still green, we designate by the name of *intermediate*.

3. Those which before dehiscence are transparent, almost dry, and whose seeds are colored, we will call *old*.

These fruits, immediately after being gathered, are burst under mercury, in bell-glasses prepared for the purpose, and the moisture of the gas is separated from the carbonic acid by means of sulphuric acid. After this first operation, the dried gas is transferred into graduated bell receivers, in which cylindrical caustic potassa indicates, after 21 hours, the absorption of carbonic acid.

We stopped at the employment of the hydrogen eudiometer, for measuring the oxygen, taking all the precautions which this means of analysis admits of. In all instances, both in estimating the carbonic acid, and in determining the oxygen, we always took account of the corrections rendered necessary in the calculation by the variations of temperature and pressure.

We will content ourselves by giving here the comparative tables of the mean quantities of carbonic acid and oxygen contained in the husks according to the state of the sky, and the hours of our experiments.

INTERMEDIATE HUSKS.

Hours of the Exprt	State of the Sky.	Oxygen per ct. in volume.	Carbonic Acid per ct. in vol	Oxgn. & Car. Acid united.
11	Night	20·496	2·746	23·242
7	Morning, dull	20·673	2·618	23·291
12	Noon, dull ..	20·908	2·429	24·337
4	Afternoon, dull	20·901	2·432	23·383
7	Morning, sun	21·086	1·903	23·989
12	Noon, sun ..	21·293	1·419	22·712
4	Afternoon, sun	21·173	1·438	22·614
			Mean	23.081

YOUNG HUSKS.

11	Night	20·583	2·639	23·222
7	Morning, dull	20·626	2·605	23·231
12	Noon, dull ..	20·766	2·446	23·012
4	Afternoon, dull	20·743	2·475	23·218
7	Morning, sun	20·844	1·934	22·778
12	Noon, sun ..	21·032	1·762	22·794
4	Afternoon, sun	21·246	2·098	23·339
			Mean	23·085

OLD HUSKS.

11	Night	19·297	2·942	23·239
7	Morning, dull	20·166	2·509	22·775
12	Noon, dull ..	20·626	2·461	23·087
4	Afternoon, dull	29·595	2·475	23·070
7	Morning, sun	21·139	2·316	23·455
12	Noon, sun ..	21·246	2·106	22·342
2	Afternoon, sun	20·676	2·107	22·783
			Mean	22 965

Observations on these Tables.—1. These numerical results demonstrate that the air of the husks is much more rich in carbonic acid than atmospheric air.

2. They demonstrate, in a striking manner, that the quantity of carbonic acid is greater at night than in the day; and if we take the two extreme examples, that of eleven o'clock at night (2·746), and that of the moment when the light presents its maximum of intensity (1·419), it is evident that the proportion is as large again in one case as in the other.

3. These Tables, in giving as a point of departure the examples of the night, also enables us to follow the progressive diminution of the carbonic acid, until the moment when it seems to stop. It is thus evident that the decomposing force of light increases with its intensity and the duration of its action; or that the hours of the same day, fine or dull, be followed, or that the results given by an entirely cloudy sky, be compared with those furnished by a burning sun.

4. It is also remarked that, with respect to the age of the husks, the reduction of carbonic acid is in ratio with the force of vegetation.

5. As a proof of the very limited permeability of the carpellary leaves of the bladder-nut tree, we refer to the column of oxygen where it is seen that the proportions of this gas increase in the fruit in proportion as the carbonic acid is decomposed in it: the relations which exist between the carbonic acid disappeared and the increased quantity of oxygen are precisely such that this increase of oxygen may be regarded as arising from the acid, which, in being decomposed, yielded its carbon to the plant.

6. We may remark, besides:—1st, that by uniting the oxygen with the carbonic acid, we obtain on the average 23; 2nd, that the corbonic acid always displaces nitrogen, and sometimes a little oxygen; but this latter case exists only when the proportion of carbonic acid is great, as the first example of each series indicates.

The experiments of Hennebier and de Saussure, and those of Dumas, Boussingault and Liebig demonstrated the fixation of carbon by vegetables; *but we may be inclined* to make known, by these results, the mode of action which light exerts in this reduction, which begins with the crepuscule and continues in the day in diffused light; which does not agree with the ideas concerning the fixation of carbon, admitted only in the case in which the plant was directly struck by the rays of the sun.

The third chapter of our memoir comprises the chemical examination of the air contained in the interstices contained in a certain number of hollow stems, collected in full vegetation, and whose gas we immediately passed under bell receivers filled with mercury. In the manipulations necessary for this work, we carefully avoided all circumstances calculated to cause a mixture of the air of the stems with the external air.

The gases obtained and dried, like those of the husks, by sulphuric acid, gave us, with caustic potassa and eudiometrical experiments, the following results:—

TABLE OF THE QUANTITIES OF CARBONIC ACID IN VOLUME.

Name of the Plants.	Experiments of the night. Carb. Acid per cent.	Experiments of the day. Carb. Acid per cent.	Increase of Carbonic Acid in the night.
Heraclium sphondylium	....	1·408	....
Angelica archangelica	2·587	1·766	0·815
Ricinus communis.....	3·078	2·721	0·347
Dahlia variabilis	3·133	2·881	0·252
Arundo donax	4·619	4·407	0·212
Leicesteria formosa.....	2·879	2·267	0·612
Sonchus vulgaris.....	....	2·326	....

TABLE OF THE QUANTITIES OF OXYGEN IN VOLUME.

Name of the Plants.	Experiments at night. Oxygen per Cent.	Experiments in the day. Oxygen per Cent.	Increase of Oxygen in the night.
Heraclium sphondylium	....	19·653	....
Angelica archangelica	20·364	19·784	0·580
Ricinus communis.....	18·656	16·876	1·780
Dahlia variabilis	18·823	18·119	0·704
Arundo donax	18·691	18·193	0·498
Leicesteria formosa	19·137	18·703	0·434
Sonchus vulgaris.....	19·774	17·971	1·803

1. From these tables it results that the air confined in the stems has a peculiar composition, very different to that of atmospheric air, as is indicated independently of the oxygen, by the great quantity of carbonic acid, a quantity which increases with the force of the vegetation.

2. It results from this explanation that the quantity of carbonic acid is greater in the night than in the day, but the difference is far from being so great as in the case of the husks. This second fact may, in our opinion, be explained by this circumstance, namely, that the whole stalk, the descending and ascending caudex, and the roots contribute to absorption, whilst the diminution is produced only by the ascending part of the caudex, whose surface is exposed to the decomposing action of light.

3. We may also observe that in the stalks the oxygen increases in the night with the carbonic acid, which is contrary to what we noticed with respect to the husks.

The importance of ammonia has lately been put beyond doubt, by the learned investigations of Dumas, Boussingault, and Liebig; but a passage in the *Essai Statique Chimique des êtres Organisés* of M. Dumas, having given rise to some doubt in our mind, on this subject, we thought that it would be interesting for science to ascertain whether the ammonia of the air contributes directly to the presence of the nitrogen combined in plants, and we think that we have demonstrated this fact in a certain manner, by discovering ammonia in the gaseous state in the air contained in vegetables.

DETERMINATION OF THE AMMONIA ESTIMATED IN THE STATE OF DOUBLE CHLORIDE OF PLATINUM AND AMMONIA.

Quantities of gas employed.	Name of the Plants.	Period of the Experiments.	Quantities of double salt.
555	Leicesteria formosa	Night	0·0080
360	*Idem* *Idem*..	Day	0·0150
330	Arundo donax	Night	0·0060
370	*Idem* *Idem*	Day	0·0085
1170	Ricinus communis..	Night	0·0100
1160	*Idem* *Idem*....	Day	0·0120
940	Phytolacca decandra, with fruits	Night	0·0070
1140	*Idem* *Idem*..	Day	0·0155
940	Phytolacca decandra, with and without flower.....	Day	0·0250
1650	Intermediate husks	Night	0·0970
473	*Idem* *Idem*..	Day	0·0050
		Total	0·1890

IMPROVEMENTS IN COATING GLASS WITH SILVER FOR LOCKING-GLASSES, &c.*

PATENT GRANTED TO THOMAS DRAYTON.

A MODE of silvering glass, for looking-glasses and other uses, without the employment of quicksilver, constitutes the subject of this patent: it consists in depositing silver, from a solution, upon glass, by deoxidising the oxide of silver in solution, in such a manner that the precipitate will adhere to the glass, without the latter having been coated with metallic or other substances.

A mixture is first made of one ounce of coarsely-pulverised nitrate of silver, half an ounce of spirits of hartshorn, and two ounces of water; which, after standing for twenty-four hours, is filtered (the deposit upon the filter, which is silver, being preserved), and an addition is made thereto of three ounces of spirit (by preference, spirit of wine), at 60° above proof, or naphtha; from twenty to thirty drops of oil of cassia are then added; and, after remaining for about six hours longer, the solution is ready for use. The glass to be silvered with this solution must have a clean and polished surface; it is to be placed in a horizontal position, and a wall of putty, or other suitable material formed around it; so that the solution may cover the surface of the glass to the depth of from an eighth to a quarter of an inch. After the solution had been poured on the glass, from six to twelve drops of a mixture of oil of cloves and spirit of wine (in the proportion of one part, by measure, of oil of cloves to three of spirit of wine) are dropped into it, at different places; or the diluted oil of cloves may be mixed with the solution before it is poured upon the glass. The more oil of cloves used, the more rapid will be the deposition of the silver; but the patentee prefers that it should occupy about two hours. When the required deposit has been obtained, the solution is poured off; and as soon as the silver on the glass is perfectly dry, it is varnished with a composition formed by melting together equal quantities of bees'-wax and tallow. The solution, after being poured off, is allowed to stand for three or four days, in a close vessel; as it still contains silver, and may be again employed after filtration, and the addition of a sufficient quantity of fresh ingredients to supply the place of those which have been used. The patentee states, that, by experiment, he has ascertained that about eighteen grains of nitrate of silver are used for each square foot of glass; but the quantity of spirit varies somewhat, as its evaporation depends upon the temperature of the atmosphere, and the duration of the process.

If the glass be placed in an inclined, or even a vertical position, and the surface covered over, leaving a narrow space for the solution between the surface of the glass and the cover, which fits close, then, by using spirit without water in the mixture, the object will be accomplished. By the addition of a small quantity of oil of carraway or thyme, the color of the silver may be varied. The oil of cassia, purchased of different manufacturers, varies in quality; therefore, if, on being mixed with the solu-

* Newton's *Journal*.

tion, it should become flaky, the solution must be filtered previous to use.

The patentee, in concluding his specification, says, that he does not confine himself to the precise details herein described, provided the peculiar character of the invention be retained, whereby silver is deposited on to glass from a solution of that metal, by deoxidation, in such a manner as to cause the silver to adhere to glass, without any previous coating of the latter.

MANUFACTURE OF A COLORING MATTER CALLED GARANCINE.*

PATENT GRANTED TO FREDERIC STEINER.

THIS invention consists in manufacturing a certain coloring matter, called Garancine, from refuse madder, or madder which has been previously used in dyeing; such madder having, prior to this invention, ordinarily been thrown away, as spent, and of no value, and the said coloring matter, called Garancine, having been produced heretofore from fresh or unused madder. The manner of carrying the invention into effect is as follows:—Outside the building in which the dye-vessels are situate, a large filter is formed, by sinking a hole in the ground, and lining it at the bottom and sides with bricks, without any mortar to unite them. Upon the bricks a quantity of stones or gravel is placed, and over the stones or gravel common wrappering, such as is used for sacks; below the bricks is a drain, to take off the water which passes through the filter. In a tub adjoining the filter, a quantity of dilute sulphuric acid, of about the specific gravity of 1·050 (water being 1·000), is kept. Hydrochloric acid will answer the several purposes for which sulphuric acid is used; but the patentee prefers sulphuric acid, as more economical. A channel is made from the dye-vessels to the filter. The madder which has been employed in dyeing, and which is in the state considered as spent or refuse madder, is run from the dye-vessels to the filter; and while it is so running, a portion of the dilute sulphuric acid, sufficient to change the color of the solution, and the undissolved madder, to an orange tint or hue, is run in, and mixed with it. This acid precipitates the coloring matter which is held in solution, and prevents the undissolved madder from fermenting, or otherwise decomposing. When the water has drained from the madder, through the filter, the residuum is taken from off the filter, and put into bags. The bags are then placed in a hydraulic press, to have as much water as possible expressed from their contents. In order to break the lumps which have been formed by compression, the madder, or residuum, is passed through a sieve. To five hundred-weight of madder, in this state, placed in a wooden or leaden cistern, one hundred-weight of sulphuric acid of commerce is added, by sprinkling it on the madder through a leaden vessel, similar in form to the ordinary watering-can used by gardeners. The madder is then worked about, so as to mix it intimately with the acid. In this stage the madder is placed upon a perforated leaden plate, which is fixed about five or six inches above the bottom of a vessel. Between this plate and the bottom of the vessel a current of steam is introduced, by a pipe, so that it passes through the perforated plate, and the madder which is upon it. During this process, which occupies from one to two hours, a substance is produced, of a dark-brown color, approaching to a black. This substance is Garancine, and insoluble carbonised matter. It is next thrown on the floor to cool; and, when cool, is placed upon a filter, and washed with clear cold water, until the water passes from it without an acid taste. The substance is then put into bags, and subjected to hydraulic pressure; it is next dried in a stove, and ground to a fine powder under ordinary madder stones, and afterwards passed through a sieve. In order to neutralise any acid that may remain, for every hundred-weight of this substance, from four to five pounds of carbonate of soda, in a dry state, are added, and intimately mixed therewith: the Garancine in this state is ready for use.

The patentee claims the manufacture, above described, of the coloring matter called Garancine, from madder which has been previously used in dyeing, and which is usually called spent madder.

* Newton's *Journal*.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THE PROGRESS AND PROSPECTS OF THE PHARMACEUTICAL SOCIETY.

It is truly ludierous to observe with what obliquity of vision the editor and his subordinates of the *Pharmaceutical Journal* find matter with which to console and congratulate themselves upon the state of things in their body corporate.

With a defection from their ranks of about 500 members and associates—with loud threatenings of further secession in every quarter—with continual and just demands for the reduction of the annual subscription—with perpetual complaints of the appropriation of the funds—and with the disgust felt by every one at the arrogant, partial, and twaddling tone of their journal, it will be evident to all that the seed of decay is sown in the most vital parts of the Society, which the delusive charter of incorporation cannot save from a speedy dissolution.

Notwithstanding all the endeavors of the Council to accumulate a large fund, while the Society is well supported, under the pretence of giving it a firm basis, when the real object is to render it independent of, and free from, the control of the members, we can confidently tell them that they will most signally fail in their attempt, and that no society ever did or can prosper which had not for its real object the welfare of those for whom it was ostensibly instituted.

In fact, like many other bubble societies of the present day—got up for the benefit of some needy and designing men, and which only have existed while they brought lucre in the pockets of their projectors, and blinded the eyes of their victimised supporters—the Pharmaceutical Society's days are numbered, its intentions are suspected, and its objects exposed. Look to this, Messrs. Bell, Redwood, and Smith, "make hay whilst the sun shines," for the day of retribution is at hand. By cramming down the throats of the members a journal, which is alone supported by, and owes its very existence to, the Society, and which advocates and promulgates the feelings and opinions of the Council, and yet is irresponsible to it, and which purports to be the medium of communication between the members, and yet only publishes those communications which are consonant with the views of the editor; the Council have placed themselves in this awkward dilemma, viz., that they must either sever their connection between that unnatural excrescence of the Society—the journal—or lose the support and advice of every well-wishing member.

We call upon the Council to pause before they proceed further in this anomalous and fatal career; let them conciliate the good opinion of the members—let them render the objects of the Society, not the emolument and advantage of the few, but the advancement, scientific and social, of the many.

W. B.

THE MEDICAL TIMES AGAIN.

To the Editors of The Chemist.

Gentlemen—

Is there any common honesty in the case of the proprietor of a periodical who makes most liberal and tempting promises in an advertisement, which he does not half fulfil in the performance? In such a predicament is the editor of the *Medical Times*. In what grandiloquent terms did he laud his forthcoming Pharmaceutical number! And yet what is the result? A mere selection, made without judgment, from other chemical periodicals, prefixed to which is an advertisement which, it is easy to see, from the gross breaches of the rules of grammar, and the attempt at sentimentalism, is an original. The two papers most highly valued by the editor are, 1st, a translation of the "Annuaire de Therapeutique" of Dr. Bouchardat, and 2nd, a paper on the sulphites, by Dr. Muspratt. The former is a *fragment*, though one might have supposed, by the advertisement, that the whole was to be given. It professes to present an account of the discoveries made in Therapeutics during the past year. It appears from this paper that it was reserved for the year 1843 to find out how a preparation known by the name of camphorated oil was to be made. The following is the recipe for this extraordinary novelty:—"*Camphorated Oil.*—Five parts of oil with one part of camphor dissolved in it." Of course the readers of the *Medical Times* will look out anxiously for another part of the translation of this work, in which they may, perhaps, have the whole of the London Pharmacopœia "done" out of French into English, and presented as an

account of the discoveries of the past year. The paper on the Sulphites, by Dr. Muspratt, appears to be an inaugural dissertation written in order to obtain his degree at Giessen, and may be a creditable performance. This paper is also a *fragment*, a circumstance which the writer of the pompous advertisement studiously kept out of view. An article by Dr. Playfair, occupying nine columns, follows, cut out of the *Northern Journal of Medicine*, and a review of Fresenius and Will's Tract on Alkalimetry is introduced, in which the reviewer justly blames the editor for allowing the French names of weights and measures to remain untranslated, without appearing to remember that the same charge applies to his own translation of the "Annuaire de Therapeutique."

After a few more extracts from contemporaries, we arrive at a wholesale act of appropriation, in which nine articles are taken from *The Chemist*, and twenty-eight from *The Chemical Gazette*, so disposed in the printing as to lead the uninitiated to imagine that all the thirty-seven articles, except one from each periodical, rightly belong, either as originals or translations, to *The Medical Times*. Again I ask, is this honest? Is it fair towards yourselves, or towards the editors of *The Chemical Gazette*, who are not dependent upon the scissors for a supply of matter? And is it not a palpable cheat attempted to be put upon the readers of advertisements, who will scarcely be prepared to expect such robbery and quackery, unless they have been frequently deluded by them, like

Your obedient servant,
EBORACENSIS.

HISTORY, ANALYSIS, AND PRESERVATION OF ERGOT OF RYE.

BY VICTOR LEGRIP.

ERGOT of rye, which has been employed for nearly a century in medicine, has been the subject of opinions frequently opposed to one another. The effects which, at first, were most generally attributed to it induced the authorities to prohibit its use. At the commencement of the nineteenth century, Dr. Stearns, of New York, again extolled it, regulated its employment, and finally assigned to it a rank among the most powerful medicinal agents. Since then, Drs. Bellardini and Quill, MM. Roux, and Hervez, Baudilocque, Chevreul, and Villeneuve, have so well established the obstetrical property of ergot of rye, that, notwithstanding a host of contradictory authorities, that of M. Capuron and many others, this substance is almost generally employed, however easy an accouchement may be. Does it always produce the desired effect? This our position does not enable us to establish; we would first ask, how many accouchements per cent. might have been made *sine pulvere ad partem!* A judicious reply might much diminish the reputation of this product.

It does not belong to us to set at nought the employment of a pharmaceutical drug; but we should prefer, however, that the property recognised in it should be established on the existence of a principle discovered by a chemical analysis, as is the case with quinquina, senna, simaruba, &c., &c. Unless it be the same also with ergot of rye, its reputation is such that it will soon become a universal panacea. There is attributed to it a powerful action on the uterus embarrassed with the placenta, on the bladder in retention of urine, on the chest in dyspnœa, on the stomach, &c.; it is recommended in paralysis, blennorrhagia and blennorhœa rebellious to all things known, and as a valuable hœmostatic against all sanguine emissions. At the same time that this substance is said to act energetically in the different morbid states which we have just mentioned, it is considered to have no action on the healthy individual; it acts neither on the digestive organs nor on the encephalus, nor on the circulation; it has no action on the uterus before two months after conception. After these remarks, we ask if ergot of rye has no effect on healthy men? If M. Goupil has employed it without any symptom in the dose of one drachm? If Parmentier has also used it, and on himself, in this same dose for eight days, without being able to attribute to it any effect? If M. Muller is so far from sharing the fears of many physcians in the employment of ergot of rye, that he administers it in the enormous doses of from six to eight drachms? How are we to explain not only the gangrenous contagion which is imputed to it, but also the death with gangrene; also, in some individuals who have taken a few small doses of it, and finally, that with the same attack of different animals, birds and beasts, which, notwithstanding their repugnance, were made to eat it.

Before terminating this review of the various opinions concerning ergot of rye—opinions which we do not intend to refute seriously—we will glance at the botanical descriptions of it which have been given. Some have regarded it as a species of itch, others as a morbid excrescence, without admitting that it was, as in the first opinion, the result of

the sting of an insect. Some have regarded it as a monstrosity, others as an altered grain. The name of *Sclerotium clavus* would appear more proper for designating it; but should we comprise, under this denomination, the entire ergot, or only some of its parts? There were, doubtless, few botanists who, with Mr. Smith, of the Linnæan Society of London, did not think that the fungus of ergot was even its envelope, and it appears that the microscopical observations of this *savant* have entirely confirmed his opinion.

M. Baudilocque, in a report on a memoir by M. Chevreul (D'Angers), in thinking that there should be a difference of action between the different parts of ergot of rye, considered as an active part of its bark, if it may be so called, otherwise the fungus crust, which he called *Sphacelaria segitum;* he desired, in the name of the Commission, the employment, or at last the trial of the isolated *Sphacelaria*. As it is doubtful that the crust of ergot of rye is ever employed alone in pharmacy, it appears to us more rational to designate by a suitable name the entire ergot, and not only one of its parts; therefore we continue, with M. Chevreul, to call it ergot of rye, and otherwise *semen fedatum secalis*.

The following is the analysis, which the desire of a just appreciation of the thing has made us undertake and follow, in the hope that it may be of some use to the practitioner.

The ergot on which we operated was fresh; the powder was dried at O × 50. A hundred grammes of this powder were treated by cold sulphuric ether, by a new mode of accelerating displacement; the ethereal tincture was set aside under the denomination *a*.

The mass deprived of the ether, which it might retain by a sufficient exposure to a gentle heat, was treated by boiling alcohol at 36°. Exhausted by this menstrum, the alcoholic tincture was set aside under the designation *b*.

The mass dried *de novo*, was immediately treated by boiling water, until perfectly exhausted. Half of the aqueous tincture was immediately evaporated by steam to the consistence of an extract, then set aside and ticketed *c*.

The other half was immediately tested with several re-agents; we will make known the results, in returning to this product, under the designation *d*.

The mass, exhausted by water, was completely dried and weighed as often as the former operations, in order to ascertain the diminution of weight; it then weighed 48 grammes.

Of these 48 grammes of residue, 12 grammes were treated with heat by a solution of ammonia, and designated *e*. Another portion, likewise, of 12 grammes, was boiled with water, acidulated by sulphuric acid, and the acid decoction produced was marked *f*.

Finally, the remaining 24 grammes of the residue were burnt in a close vessel. Here the gaseous products were neglected; those collected in the adapter and receiver weighed 16 grammes—namely, 1·75 ammoniacal salt, 5·0 empyreumatic oil, 9·25 tarry water and acetic acid. There remained in the retort 7·25 of light, shining, and friable charcoal. This charcoal was incinerated; there remained after this operation 0·8 of ash; this was treated by boiling water. This aqueous solution was marked *g*. The residue of this solution was dissolved in hydrochloric acid; it was heated almost to desiccation, re-dissolved in water, and, after filtration, this solution was ticketed *h*.

Finally, that which resisted the action of hydrochloric acid was submitted to that of nitro-hydrochloric acid; it was evaporated almost to dryness, then treated with distilled water; it was then filtered, and this solution in nitro-hydrochloric acid was marked *i*.

We had also a residue from this operation of the weight of 0·075 gr. In order to terminate here our preliminary operation we regarded it as silica.

The ethereal tincture *a* was distilled as slowly as possible; there remained in the retort 34·5 gr. of fixed oil. This oil was of a fine yellow; it became thick by cooling; it was perfectly fluid and limpid only at O × 25, a temperature at which ether will separate from it. By filtration, at this same temperature, we separated from it a small quantity of black matter, of a resinous aspect and almost tasteless. This oil, of a very powerful odor, somewhat resembling that of sperm oil, and not the disagreeable odor of ergot of rye; it is less disagreeable to the taste than that of *Madia Sativa;** it contains—olein 73, stearine 27.

The alcoholic tincture *h*, of a deep color, formed a turbidness in water; the greatest part of the alcohol was distilled over, in a sand-bath; there did not pass over with it any principle capable of being isolated, although it had a little odor. That which remained in the retort was turbid, and of a deep brown, and was evaporated over water which was not boiling. This deliquescent extract, of a powerful and disagreeable odor, appeared to us, more than any other product, to contain the active part of ergot of rye; it dissolved only partially in cold water, which, by

* Oil of *Madia Sativa*, when well prepared, is not disagreeable to the taste.—A. C.

evaporation, gave a gummy saccharine extract, containing a little animal matter (osmazome.) The insoluble portion was entirely re-dissolved in hot water. On cooling, a slight turbidness was produced, then a light whitish precipitate; this was inulin. Filtered, the greatest part of the alcohol was removed by slow distillation; to the remaining part, which began to become turbid, cold water was added: a large quantity of very brown resin was precipitated; notwithstanding numerous washings, it could not be obtained less colored. The aqueous extract *e*, of the weight of 11 grammes, re-dissolved in hot water, deposited inulin by cooling; alcohol precipitated from it much gum; iodine indicated the presence of amidin. Having, after filtration, distilled over the alcohol, the remainder was brought to the state of extract; the latter, on burning coals, gave out at once the odor of animal matter and that of burnt bread.

The aqueous tincture *d*. Remembering that M. Boujeau attributes to the aqueous extract of ergot of rye an eminently hœmostatic property, we thought that it must contain an astringent principle—tannin, for example; but we in vain tested for it by the solution of gelatine, and by a salt of iron. On the other hand, neither ferrocyanuret of potassium, nor tincture of galls caused any precipitate. This aqueous tincture was colored blue by iodine; lime, potassa, and ammonia gave rise to a light and flocculent precipitate, which, on burning coals, produced an odor of burnt bread; subacetate of lead produced an abundant precipitate. This precipitate, treated by dilute sulphuric acid, abandoned fungic acid, which we combined with ammonia, for greater certainty; and from the portion of tincture on which we had poured the salt of lead, the excess of lead was removed by a current of sulphuretted hydrogen, and the excess of the latter was expelled by sustained boiling. Then this liquor was submitted to the following tests:—Nitrate of silver, an abundant, white, coagulated precipitate, insoluble in nitric acid; hydro-sulphate of ammonia, fawn-colored turbidness, due to fungin; oxalate of ammonia a dull white precipitate; ammoniacal sulphate of copper, a precipitate of oxide of copper, produced by an alkali contained in the liquor, for a portion of the concentrated liquid gave with chloride of platinum an abundant yellow precipitate. Thus, the potassa constituted in it, with the fungic acid, fungate of potassa; lime gave a light precipitate in it; the salts of baryta did not indicate the presence of sulphuric acid.

(*To be concluded in our next.*)

POISONING BY EUPHORBIA LATHYRIS.*

BY M. JACOB.

(*Concluded from page* 328.)

Without dwelling here on the details of the experiments which it was necessary for us to make, in order to arrive at this end, I will confine myself to stating, that chemical analysis showed the presence of sulphur and a small quantity of animal matter, without the slightest trace of arsenic in the precipitate furnished by sulphuretted hydrogen.

It also demonstrated to us, that that furnished by lime-water was only the result of the decomposition of a soluble carbonate, by means of that base; that the yellow precipitate furnished by nitrate of silver was produced by a mixture of chloride of silver and phosphate of the same base, whence its incomplete solubility in ammonia; finally, that the green coloration, and, subsequently, the green precipitate, furnished by the ammoniacal sulphate of copper, must be attributed, the former to the mixture of the reagent with the yellow liquor, the latter to a small quantity of animal matter colored by the liquid.

It is evident to what serious errors, in such circumstances, the toxicologist would be exposed if, relying on these external characters of coloration, he were induced to decide that he had discovered the poison. We cannot too carefully put in practice the wise precepts of our celebrated toxicologist in regarding these various precipitates as conclusive, only with the greatest reserve.

Notwithstanding these results, and, in order to leave no doubt in our mind, we applied Marsh's apparatus to the investigation of this poison, following, for the carbonisation of the flesh, the process directed by the Institute. After having ascertained the purity of our reagents, we set this apparatus in operation for an hour; this long experiment not having furnished the slightest trace of arsenic, we thought it right to assure ourselves of the sensibility of our apparatus.

We dissolved in 30·0 of distilled water 0·003 of arsenious acid, which we introduced into our apparatus while still in operation, and we soon observed in the tube rings evidently formed by arsenic, and, notwithstanding this deposit, sufficient undecomposed gas was disengaged to enable us to cover a porcelain plate with arsenical stains.

DETECTION OF VEGETABLE POISONS.

Chemical analysis not having enabled us to detect the slightest trace of mineral poison,

* *Journal de Chimie Médicale*, June 1844.

we thought it our duty to endeavor to find, among the organic substances which can be detected, that which might have caused the death of the Sieur G.

The substances to whose investigation we principally paid attention are—morphia, strychnia, brucia, and hydrocyanic acid.

We took a portion of the liquid at a very gentle heat, and treated the residue by boiling alcohol. The filtered alcoholic liquor was deeply colored; it was divided into several portions; we evaporated one to the consistence of an extract; this extract, redissolved in boiling distilled water, was acidulated with a few drops of acetic acid; then treated by subacetate of lead, in order to free the liquor from its coloring matter, and afterwards submitted to a current of sulphuretted hydrogen gas to deprive it of the excess of the precipitating salt; again filtered and concentrated, this liquid was tested by nitric acid and chloride of iron; these two reagents did not furnish any of the reactions of the salts of morphia.

In two other portions of the alcoholic liquid, we in vain endeavored to detect, by means of nitric acid and chloride of tin, the presence of brucia, as well as by ammonia and tincture of galls, that of strychnia.

Although, on the opening of the stomach and intestines, we had not perecived any odor of hydrocyanic acid, we put with water in a retort, a small portion of these organs, as well as a portion of the liquid of the greenish matter contained in the stomach, and we distilled it; the product of this distillation did not indicate, under the influence of reagents, a trace of this acid.

Whence we have concluded:—

I. That the death of the Sieur G. was not the result of the action of a mineral poison, since analysis did not detect the presence of any poisonous mineral salt.

II. That it was not the result of poisoning by one of those vegetable substances which chemistry is able to detect.

III. The physical and botanical examination of the plants found in Sieur G.'s house and on his dung-hill, showed us that these plants were the following:—*Semen contra (Artemisia contra)*, stalks of elder *(Sambucus ebulus)*, a stalk of garden celery *(Apium dulce)*, a foot of *benoite (Geum herbanum)*, commonly called *caryophyllata*, on account of its odor of cloves, and which the inhabitants of the country use in all diseases as an universal panacea.

IV. Finally, that as none of these plants possess any dangerous properties, it is impossible to attribute to them the serious symptoms which caused the death of Sieur G.

Note.—Notwithstanding these conclusions, notwithstanding the public Minister having desisted from the prosecution of this affair, the scandalous conduct of the accused, the widow of the Sieur G., having again excited public rumor, the authorities thought it necessary to make some further investigations, from which it appears almost certain that the poisoning of the Sieur G. had been effected by means of a bitter, oleaginous seed, which I have ascertained to be that of *Euphorbia lathyris*. It would appear that this woman bruised the seed and administered it in wine to her husband; the latter, although drunk, would have refused, finally, to drink this wine, saying, that it burnt his body. I was last year enabled to judge of the deleterious action of this seed, seven little children having fallen victims to eating a certain quantity of it. It is to be feared that such accidents may be of frequent occurrence, from the habit of many country people using it as a purgative.

REDUCTION OF MERCURIAL COMBINATIONS BY ORGANIC PRINCIPLES.*

BY DR. RIEGEL.

Physicians, generally little versed in the knowledge of chemico-pharmaceutical phenomena, which they should, however, take as their principal guide in prescribing, are in the habit of prescribing the addition of mercurial salts, and particularly of the bichloride, to certain syrups, such as those of Cuisinier, Saponaria, Dulcamara, &c. Now, these are precisely the kinds of pharmaceutical preparations most liable to be deteriorated after being delivered to the patients, because they are ordinarily prescribed in considerable quantities at a time, and because, requiring particular care in their preservation, they are speedily spoiled in the hands of persons unacquainted with the art of pharmacy.

Dr. Riegel has made a series of experiments, from which it results that yeast and other fermentable bodies are apt to produce a decomposition (reduction) of mercurial combinations.

These results confirm the experiments formerly made by MM. Schacht and Wackenroder, and show the necessity of no longer prescribing compound syrup of sarsaparilla, with the addition of corrosive sublimate, in bottles of half a kilogramme, or even one kilogramme, as is at present done.

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* *Jahrbuch für Praktische Pharmacie*

ON SAGAPENUM AND ELEMI.

BY A. J. COOLEY.

SAGAPENUM.—This substance is described in the London Pharmacopœia as a gum resin, the production of an uncertain species of ferula. Willdenow, Sprengel, and Fée considered it to be the produce of the Ferula persica, but this opinion appears to be unsupported by any direct evidence (Pereira), and up to the present time the question is quite as unanswerable as it was 2,000 years ago. What renders this ignorance the more singular is, the fact that sagapenum is not a medicine of yesterday, but was known to antiquity. Hippocrates, who died B. C. 361, as well as Dioscorides, mention this substance; and the latter even asserts, that it is the liquid produce of a ferula growing in Media. Pliny, the Roman naturalist, also mentioned "SACOPENIUM" nearly 1,800 years ago.

The sagapenum of commerce is either met with under the form of agglutinated tears, of a yellowish brown color, or in tough irregular masses. It possesses an odor and appearance intermediate between assafœtida and galbanum. When heated it evolves a peculiar smell, partaking of garlic and juniper, which is neither so powerful nor disagreeable as that of the fœtid gum. According to the analyses of Pelletier and Brandes, it consists of:—

	Pelletier.	Brandes.
Resin, soluble in alcohol, and partly soluble in ether	54·26..	50·29
Gum	31·94	
Do. with calcareous salts		32·72
Volatile oil, of a yellow color, lighter than water, smelling strongly of assafœtida, and soluble in ether and alcohol	7·20..	3·73
Bassorin	1·00..	4·48
Malate of lime Phosphate of ditto, &c.	1·00..	1·12
Loss (water)	4·60..	4·60
Foreign matter		4·30
	100·00	101·24

This gum-resin is only employed in three preparations to my knowledge, and those are, the pilulæ sagapeni co., the pilulæ galbani co., and the conserva rutæ, or confectio rutæ, of the London and Dublin Pharmacopœias. It is seldom administered alone, but when it is the dose varies from 5 grains to half a drachm. In the first of the above preparations, it forms $\frac{10}{17}$ths of the dry ingredients, in the pil. galbani co. (P. L.) $\frac{1}{3}$, and in the confectio rutæ $\frac{2}{21}$. It is therefore evident, that the attention of the dispenser should be directed to the purity of a medicine administered in such large quantities. It is a painful fact, however, that the mass of the sagapenum sold to the retail trader is factitious, and formed by mixing together assafœtida, galbanum, and other drugs in variable proportions. This is generally done by the conscientious druggists, by softening a mixture of 3 parts of assafœtida and fourteen parts of galbanum, in a water or steam-bath, and then stirring in about $\frac{1}{17}$th of their weight of turpentine, to which a little oil of juniper has been added. This mixture is called "gummi sagapeni OPT.," an inferior sort being made by adding sundry portions of yellow resin and paste of gum tragacanth to the above. So much for the honesty of men who, for the sake of a small additional profit, at once trifle with the health and pick the pockets of those who confide in them. It is a painful fact, but too true and too palpable to be denied, that much of the skill and exertions of the faculty are neutralised by the inferior quality of the drugs and preparations which are employed in dispensing their prescriptions. Much of this arises from the cupidity of the retailer inducing him to purchase the lowest priced articles offered him for sale; but a still more fertile cause, is his total inability to discriminate one quality from another. The ease with which inferior and often spurious drugs are sold for those of good quality has so encouraged the practice among some unprincipled traders, that they do it with the utmost carelessness, and apparently without the fear of detection. The only *certain* remedy against such conduct is the ability to examine and test the quality of drugs and chemicals, and the unflinching use of this valuable qualification before every purchase.

ELEMI.—This resin, like sagapenum, is the produce of an unascertained tree, respecting which there have been various conjectures. The London and Dublin Colleges assign it to the Amyris elemifera, but the Edinburgh College, with greater discretion, state it to be the "concrete resinous exudation from one or more unascertained plants." Dr. Pereira has suggested, that it may be the produce of the Icica icicariba, the Canarium zephyrinum, or the Canarium balsamiferum, but the question is still undecided.

The elemi of commerce is of a pale yellow color, exteriorly brittle, but soft and tough within; it has a warm bitter taste, and a fragrant aromatic smell, partaking of fennel and juniper. It is only partially transparent even in thin plates, is very fusible, and has a density a little greater than that of water. According to Bonastre, it consists of 84 per cent. of resin, 12·15 of

a fragrant volatile oil, and a little bitter extractive. In medicine it is only employed in the preparation of the unguentum elemi (P. L.) This substance, like sagapenum, is sometimes adulterated, but more frequently a factitious kind is sold in its place. The latter is formed by adding 1 part of balsam of Canada to 4 parts of yellow resin, previously melted, after which about 1½ per cent. of oil of juniper, and half this quantity of oil of fennel are stirred in. This fraud is readily detected by exposing the suspected article to heat, along with a little water, when its fragrance will evaporate, and the coarse terebinthinate smell and taste of the resin may be readily detected.

ON THE HYOSCIAMUS NIGER.*

BY JOSEPH HOULTON, M.D.

MEDICAL botany is a subject surrounded with more difficulties than any one would suppose who has not been practically engaged in its pursuit; to these difficulties should be attributed many of the errors existing in works on vegetable materia medica. The time, labor and expense required to verify, by personal observation, all that is expected to be said of the different species of plants that enter into the materia medica, is more than any one individual, in a professional point of view, could possibly afford, "*Nec prosunt domino quæ prosunt omnibus artes.*" The probable return would be but a poor inducement. Transcendental views offer more reward than the simply useful.

We want accurate descriptions of plants, good histories of species, but such are likely long to be desiderata; few men, competent to the task, have either time or pecuniary means to enable them to go over the plants even of our own country. That distinguished botanist, Decandolle, laments the state in which he saw descriptive botany; he says that probably not one half of the *known species* of plants have been described from living specimens; that barely a quarter of them have been sufficiently verified; and that there is scarcely a hundreth part about which one might not reasonably doubt whether they are species or varieties; and such is, I truly believe, the case. How important, therefore, is every endeavor to improve our knowledge of that which must be the foundation of medical botany, and without which it cannot exist as a science, not having sound facts for its basis.

If there is any plant in the materia medica of this country that one might expect to be well described, it is surely HYOSCIAMUS NIGER. It is a large plant, and one that is by no means rare; tons of it are brought every year into the London market, and some preparation of it is employed by almost every practitioner. Some of the species of this genus have been employed in medicine from the earliest periods of medical history; yet I cannot find any work in which the species niger has been described with the fullness and accuracy that is required for practical pharmaceutical purposes. If any one has been more fortunate in this respect I shall feel highly obliged by the information, for I have not satisfied my own mind on the points connected with its history.

It is believed by some, at least we may fairly infer so from their writings, that hyosciamus niger is the hyosciamus of Hippocrates, Dioscorides, Pliny, &c.; yet if we refer to these old writers we shall find that the hyosciamus niger was considered by them as a plant too powerful to be safely employed in medicine. Dioscorides mentions three kinds, two of which were not employed in practice in consequence of their deleterious properties; that only was used which has white seeds; he says—"*niger ut deterimus improbatur.*"

Pliny mentions four kinds; the plant with white seeds, he says, is that which is employed in medicine; this cannot be the H. niger, which has dark-colored seeds. It does not appear that the plant in question is a very old medicine. Stoërck, who wrote on hyosciamus in 1772, I have no doubt employed the H. niger, and from that period I believe we may date the medical history of the plant; and that his plant was biennial I think there can be but little reason to dispute, for although he has not said it is a biennial, yet his description of the root and leaves are quite sufficient to authorise us to consider it as such. I believe it is to Stoërck's plant that all subsequent authors refer, though they do not agree as to its duration. The fact of its being biennial is supported by the standard authors who wrote about his time, and who may truly be said to be the fathers of modern vegetable materia medica, viz.—Alston, Lewis, Bergius, and A. J. Murray. Alston, who was a good practical botanist, says that H. albus is sometimes biennial, but that the H. niger is always biennial. Persoon, La Marck, Decandolle, in his "Synopsis Plantarum," Professor Lindley, in his "Flora Medica," and Loudon, in his "Encyclopædia of Plants," make the same assertion respecting its duration. To be in doubt respecting the duration of an important medical plant is a matter of no small consequence; yet this

* Read before the Medico-Botanical Society.

doubt does exist. Authors do not agree on this point; we find some calling it an annual—some say it is both annual and biennial—one says there are two varieties of the H. niger cultivated at Mitcham, one annual, the other biennial; the same author also states that it is an indigenous plant, growing on waste ground, banks, and commons, flowering in July, but he does not inform us what is its duration in its natural state. It is very curious that some authors should put it down as a biennial, whilst others state that it is annual, and do not even mention the fact of its ever having been found as a biennial at all. We find, under very respectable authority, that this species is annual, and in the same article attributes are given to it which only belong to biennial plants, viz., that its roots have been taken up early in the spring, and eaten by mistake for parsnips. Now it is evident that the plant whose roots, early in the spring, are of sufficient size to be mistaken for parsnips, could not be an annual, for the seeds of annual plants do not germinate until the spring. I am well aware that the roots of the biennial hyosciamus niger do in the winter, and early in the spring, very much resemble parsnip-roots; numerous cases are recorded of their having been eaten by mistake for parsnips, and serious consequences have been the result. In describing this plant one of our best authors says, that "the ovary is two-celled, with numerous ovules adhering to the dessepiment." I have frequently examined this part of the plant, and could never find such adherence; I have always found the ovules attached to the placentæ, and in each cell, and quite free from any adherence to the dissepiment. I have paid considerable attention to this plant for many years; I have seen it growing in various localities, and have watched its growth in different stages of its duration. I have for several years cultivated it in my own garden and have observed its progress daily, for months, and in each successive year. I have always found it a biennial plant—I have never seen any growing wild but as a biennial. It is highly important to know that H. niger is a *biennial plant*, and to know how the leaves of the first year differ from those of the second. The plant in the first year of its duration has no stem, the leaves are all radical, each having a foot-stalk or pedicle; the leaves are woolly, but possess little of that odor which is peculiar to the mature plant, and they are destitute of that clamminess which is observed in those of the plant in its second year. I have been informed by a pharmaceutical chemist that it yields a considerably smaller proportion of extract than the plant when in flower. I do not consider the plant at this period fit for medicinal purposes; in fact, it cannot be used consistently with the College rules, as it does not flower in its first year. The rule is that "the leaves should be gathered after the flowers have opened." A few years ago it was sold very freely in Covent Garden market. I believe it is not now much used.

It is a fact, though scarcely to be credited, that in no work on materia medica or botany, unless it be very recently published, is there any account of the peculiarity of the leaf of the first year of hyosciamus niger, although an account of it was published in the medical periodicals many years ago; yet no systematic work has admitted the fact into its pages. Most respectable pharmaceutical chemists saw the value of the fact, and now act upon it, to their own credit and to the benefit of the community. The leaves of the first year die in the autumn, the root lives through the winter, and in the following spring sends up a curious tuft of pointed, pale-green, woolly leaves; they seem to rise from the crown of the root, but they are, in fact, attached to the young stem, which rises with them; the stem grows to the height, in some situations, of four feet or more; the average height is about from two to three feet; the stem, when fully developed, is well furnished with large long leaves, deeply incised, so as to appear almost pinnatified; they are sessile, and nearly embrace the stem, and have decurrent lobes, which are of a more delicate texture than the blade of the leaf. The lobes are important points to observe in examining a specimen. The leaves are very clammy and fœtid, having an odor very similar to that of the leaves of the black currant; these are the true medicinal leaves, that part of the plant now employed in medicine; they are in perfection when the plant comes into flower, which is late in the month of May or early in June, influenced in this respect by the season. In a fine mild spring it will flower in May; in a cold spring it may not flower until June; perhaps the middle of June may be generally considered the period at which they may be safely collected, seldom later, and the leaves should be gathered as soon as possible after the first flowers are blown. I do not intend to assert that they are at a later period unfit for medicinal use, but as they can never be in a better state than then, I should, if in the country, have them gathered the first fine day after I found the plant was in flower, and I should have them picked from the stem as it grows, leaving the stem, with a few of the upper leaves and flowers, to remain, that some seeds might be left to keep up the stock.

If we wait until the seed is nearly ripe, as we may do without infringing upon the directions of the College, which says, "the leaves are to be gathered before the seeds are ripe," we shall lose a considerable portion of the crop, for the best leaves will be dead, and by the time that the seed is ripe there are no longer leaves. I can see no physiological reason for believing that the leaves of any dicotyledonous plant are in a better state for medicinal purposes than at the period I have stated. Too little attention has been paid by systematic writers to the proper seasons for gathering medicinal herbs.

There are two other kinds of hyoseiamus sold in London as hyosciamus niger; I am not aware that there are more. I did not know of more than one of the spurious kinds until the present year. I will endeavor to give some account of each of them. The first kind might have been seen in various parts of the Royal Botanical Gardens, Regent's-park, last year. I had above twenty specimens growing at the same time in my own garden; those I raised from seed that was politely furnisned me by Mr. Tipple, surgeon, of Miteham, where the plant is cultivated for sale. I received the seeds together with some roots of the true hyosciamus niger—the little parsnip-like roots mentioned by some of the older writers—these I planted, but they never came up. Mr. Tipple sent me some seeds of the hyoseiamus niger also; these I sowed, and had a good crop of first year's plants. I had thus a fair opportunity of comparing the two kinds. The true hyosciamus niger grew as I have described it.

The other kind was a smaller plant; its leaves of a paler hue, nearly ovate, and with few incisions, nothing of the pinnatified character about them; some of the upper leaves were entire and ovate; on some leaves scarcely any hairs could be observed, they were nearly glabious, and the lower ones petiolated; the uppermost were sessile. but these had but small decurrent lobes; the leaves were neither clammy nor fœtid, they had only a fain hyoseiamus smell. The main stem divides into three, springing from a common centre, each becoming about as long as the main stem. The reproductive organs were similar in all essential respects to those of the true hyoseiamus niger. The plant in question is an annual plant, and flowers in July; its duration and time of flowering are the same as some of our writers of the present day put down for hyosciamus niger. But it ought to be considered as a distinct species, and should not be employed in medicine as H. niger, because it differs from it so much in its sensible properties. When plants of the same genus differ much in their sensible properties, the probability is that they differ also in their medicinal virtues; this probability is quite sufficient to lead us to prefer the old plant. Such is my opinion on this point.

The other kind to which I have alluded is an annual plant also, flowering late in July. I procured some fine specimens of it in full perfection last August. It is rather smaller than the H. niger, and larger than the other annual kind, at least so it appeared to be from the specimens I saw. I have never seen it growing. Except that the leaves are shorter and broader in proportion to their length, and less incised, it differs but little in its general appearance and odor from the true kind; the odor, however, is not quite so powerful. It is a very handsome plant. I am inclined to believe it to be a variety of the H. niger; since it is a cultivated plant, it is possible the variety may have been produced by cultivation. I think it probable that it may be a very good substitute for H. niger; in fact, it is used as such. It was sold in Covent-garden last year, and it would require the eye of an experienced practical botanist to distinguish it from the old kind. I expect it will be extensively employed in London, for by cultivating this plant the grower can return his capital much more rapidly than he can by cultivating the biennial sort, and can supply it at a cheaper rate. If this plant should come into general use, the profession and the public might benefit by it by the supply being always made equal to the demand, and a uniformity of article ensured. I am satisfied, from my experience in medical botany, that this plant is preferable to the first year's leaves of the old kind.

I beg to make a few observations on the management of the plant in a pharmaceutical point of view, for a proper plant may be spoiled by improper management. The metropolitan pharmaceutist should procure the plant entire, as it is brought to market, and when in flower. The leaves should be stripped from the plant as soon as possible after the herb is received; should delay be unavoidable, the flowers and flower-buds should be removed; for if they are allowed to remain, such is the vital endowment of the parts, so strong is the effort that they will make to fulfil the end of their being, that they will make a great demand on the plant itself, and the leaves which have been thus made subservient to their support will become pale and flaccid, and, of course, much deteriorated. The fact of flowers living upon the juices of a plant after it is removed from the

ground is very curious; the plant in question will show the fact well. The plant, when it cannot be immediately attended to, should not be allowed to lie in heaps, but should be carefully strewed about. Stoërck complains of want of care on this point in the pharmaciens of his day; he says, "Quidam relinquunt herbam recente collectam in uno cumulo per plures dies unde flaceessit et quædam pars corrumpitur." It is advisable that the leaves should be dried by the pharmacien, and without the aid of artificial heat. It is not of much importance whether they are dried in the sun or in the shade. I generally expose them to a current of dry air. If the weather should be wet it will be desirable to have a fire in the room in which the leaves are drying. Some lay great stress on the drying of leaves in the dark, but this is of no practical importance; whilst the vitality of the leaf remains, light will do it no harm, but when it is quite dead it should be kept in the dark. Living leaves require the influence of light to preserve their green color, for they do not part with their oxygen readily in the dark, and, in consequence, become pale. Gardeners take advantage of this fact in the cultivation of seakale and some other vegetables. The fact of light depriving dead leaves of their color is well known to every one. Leaves of medicinal plants are sold in London in a state in which it is very difficult to determine what species they belong to. I was shown, a few weeks ago, a sample of what was sold for folia hyosciumi; it might, or it might not have been such; I could not say what plant it was from; the leaves were broken up into very small pieces. In this state it is sent out by one of the largest houses of business in town. I understand that folia digitalis is sent out in the same state. Now, every person who prepares the tinctures should be satisfied in his own mind that he employs the proper articles in the preparation.

Hyosciamus is kept in the forms of powder, extract, tincture, and fluid juice, which is preserved by the addition of spirit. Of the relative medicinal value of these different forms I have nothing of importance to state; they are all good if carefully prepared from the proper plant at the proper season. The extract is more likely to vary in strength than any other preparation: there are many circumstances, in regard to its preparation, that may modify its properties. There are several methods of preparing extracts:—the method of the College, by which the juice is evaporated in a water-bath; the spontaneous plan, which has received the sanction of the College of Edinburgh; and the vacuum process. From Dioscorides we learn that the expressed juice of hyosciamus was inspissated *vi solis*, but we are not informed how the process was conducted.

This is all I shall say respecting the plant in reference to its natural history, its collection, and preparations. I shall conclude the paper with some cursory account of what has been said of the action of hyosciamus on the human body.

In some countries it has been employed as a luxury, to produce intoxication. Avieux states that the confectio arabum, called *benge*, prepared from a species of hyosciamus, is inebriating, and those who are in the habit of taking it cannot do without it; that it eventually produces great debility of the nervous system, irritability, and terror at the least noise. The ancients observed that hyosciamus relieved pain in a manner which they considered so like supernatural influence that, in honour of their god of physic, they called it herba Apollinaris. It has been said to have great influence upon the malevolent feelings, as they are called by metaphysicians, to stimulate what the phrenologists call the organ of combativeness; from this unamiable property it is supposed to have derived one of its names, viz., *altercum*. It is reported that the vapour from the boiling herb, or smoke of the burning seed, will turn people furious, and set them fighting, and that the effluvium from the seed that was wrapped up in paper and laid on a stove so acted on a very loving couple, who had always lived in perfect harmony, that they suddenly lost their dove-like attributes, and commenced proceedings of desperate hostility towards each other. In some instances it is said to have produced a most extraordinary kind of intellectual confusion, and in large doses to induce absolute insanity. In a monastery, where the roots had been eaten for supper, by mistake, those who partook of them were seized in the night with a curious kind of hallucination, and exhibited the most ridiculous antics, so that it was more like a lunatic asylum than a monastery; one rang the bell for matins at twelve o'clock at night; of those of the fraternity who attended to the summons, some could not read, some read what was not in the book, some saw the letters running about the page like pismires. It is related of a tailor that, under the influence of this plant, he could not thread his needle, and that when his apprentice had threaded it for him, he could not hit the cloth, but sometimes pricked his fingers and sometimes his thigh; and his needle seemed to him to have three points. In old works there are many curious effects attributed to this herb.

In the old English writers I can find but

little information respecting the medicinal virtues of the plant. In the days of Gerard the white henbane was employed; the seed was given in doses of ten grains, in coughs and various issues of blood, and mountebanks, he says, used to pretend to draw worms from the teeth by the smoke of the burning seeds; this was an imposition; the worms were small pieces of fine catgut, which the cunning charlatan had ready prepared, and by which he cheated his credulous dupes.

The first account of the employment of hyosciamus niger that I can find is in Stoërk, in his "Libellus," published in 1772. Hyoseiamus niger was in the Pharmacopœia of 1721, but was rejected in 1745, Dr. Plumtree being president and Sir Hans Sloane, a celebrated botanist, one of the fellows. It was omitted in the Pharmacopœia of 1788, and replaced in 1809. It had been much employed in this country, and had a Pharmacopœia appeared ten years earlier, I think it very probable that it would have been admitted, for its character was then pretty well established. I well remember its being employed in country practice as far back as 1804; the extract only was then kept; it was employed to allay pain and irritation in those cases in which opium was considered to be inadmissible. The old practitioners looked upon it with much suspicion, and many believed that it was unsafe to repeat it frequently, as it had a tendency, they said, to produce paralysis. It was not very extensively employed in private practice until some time after this period; this I believe from having had, at that time, opportunities of seeing practice in different parts of the country. I do not think it has been in great general demand more than twenty years; it may be considered, therefore, rather a new medicine; it is now very generally used by practitioners.

I have a letter by me from a very talented and candid medical friend, now no more, the late Dr. Thomas H. Burder, in which he gives the result of his experience on the plant in question as a remedial agent. I believe his views accord very nearly with those of the profession in general, and I shall, therefore, introduce them, and abstain from offering an opinion of my own. He says,—"I proceed to answer the questions in the order you have proposed them:—

"1. The dose I generally give to an adult, of the tincture of hyosciamus, when I wish to produce a decided effect, is twenty minims; of the extract, five grains.

"2. I have never much exceeded the above doses, having generally preferred, in cases requiring more, to combine with it some narcotic, or to exchange it entirely for some other. I have, however, sometimes observed considerable inconvenience from even the dose of ten minims, when repeated every six hours; pain and oppression of the head have been produced after three or four doses. Although given at those intervals, in another case, five minims, repeated after six hours (two doses only having been given), have been followed by pain of the head, flashing of light before the eyes, and actual delirium These effects have repeatedly followed its use in the same individual.

"3. I have found it tolerably uniform in its action, yet not to the same extent as opium. It has seemed to me to succeed more uniformly in allaying cough and pain than in producing sleep.

"4. I have chiefly given it to adults, especially to those of the female sex, and to males of a sensitive habit, or who were subject to pain or other morbid state of the head, or to constipation, and, therefore, less likely to bear opium. In bronchial irritation, and in morbid sensibility of the stomach and bowels, I have found it very useful as an adjunct to purgatives. When the mucous membrane of the stomach and bowels is irritable I consider it invaluable.

"5. When I wish to produce a decided effect I prefer the extract, although I have had but little reason to distrust the tincture. I may add that I have occasionally observed a remarkable discoloration of the tongue, almost approaching to blackness, after a full dose of henbane."

Such is the experience of an able and candid practitioner, who himself had been the subject of painful affections, and who had well watched the influence of narcotic remedies.

The poisonous effects of the plant have been thus given, in the following order of occurrence:—General excitation, full pulse, flushed countenance, redness of the eyes, headache, nausea, and sometimes uneasiness at the epigastrium, spasmodic stricture of the œsophagus, afterwards delirium, vertigo, vomiting, spasms, palpitation, aphonia, impaired vision, dilatation of the pupil, lassitude, irregular pulse, cold perspiration, sinking of the powers, coma.

It is said that acids have a powerful effect in removing the symptoms of poisoning by this plant, after evacuants have been employed.

In closing these observations, I beg to state that there remains much to be done with respect to this plant, both in a botanical and pharmaceutical point of view, and I hope some more able hands will engage in the work. Little can be done by one individual,

but great things would result from combined efforts. I would say to all engaged in the pursuit of medical botany, "*Study nature;* use books as servants, but own no master but *nature*, and verify all you can by personal observation."

ON POISONING WITH SULPHATE OF IRON.*

BY DR. CHRISTISON.

(Read before the Medico-Chirurgical Society of Edinburgh.)

THE author commenced with observing that sulphate of iron, under its vernacular name of copperas, was long thought to be an active poison; that in recent times, however, it had been found in medical practice that considerable doses could be administered without injury; that experiments on animals by Gmelin tended to prove it to be nearly innocuous to the lower animals; but that the latest inquiries, those of Smith and Orfila, showed that it is an irritant poison of no small energy, if it be retained long enough in the stomach.

He then gave an account of a medico-legal case of recent occurrence, which, along with the physiological experiments instituted on the occasion of it, illustrates the accuracy of the view of the last-mentioned author, and proves that the sulphate of iron is a poison active enough to occasion death in the human subject. A child four years of age having died in circumstances which excited strong suspicions of poisoning, an investigation was made by the law authorities nearly four months afterwards. It appeared that the child, previously in good health, was attacked with violent vomiting and purging immediately after breakfast, and died in the course of the afternoon of the same day. The person suspected in the case was proved to have purchased both sulphate of copper and sulphate of iron not long before, and was seen by other children in the house to mix a blue liquid with the porridge, which the child took for breakfast, and also to give for drink after the symptoms began a liquid of a blue color, made by dissolving a saline substance in water. Copper was naturally suspected. Mr. Dewar and Dr. James Dewar, of Dumfermline, who conducted the medical investigation, were naturally led to look for copper in the alimentary canal. There was none found, however, either by them or, subsequently, by Dr. Christison, who also analysed the contents and textures of the stomach. But there was obtained a large quantity of iron, partly in the soluble condition, but chiefly in the form of a compound insoluble in water. This appeared in a great measure to be sulphate of iron, formed by the decomposition of the sulphuretted hydrogen and ammonia disengaged during the decay of the body for water, which had acted on the contents and textures of the alimentary canal, presented evidence of a much larger quantity of sulphuric acid than would have arisen from the ordinary contents; and the whole course of the mucus coat, from the mouth to the anus, was thickly lined with a layer of jet-black mucus. The tissues of the stomach presented everywhere the same color. Iron was also found largely in numerous brown stains on the child's clothes, and on an apron worn by the person suspected to have administered the poison. The Messrs. Dewar made some experiments with sulphate of iron, from which they came to the conclusion arrived at by Orfila and Smith—viz., that two drachms retained in the stomach by a ligature on the gullet will cause death in a few hours.

It appears, then, that sulphate of iron may cause death; that, if the body be buried for some months before being examined, the iron, as in the case of arsenic in similar circumstances, becomes united with sulphur, and that the color of the contents and tissues of the stomach is thus changed to a deep black. The process employed for detecting the iron consisted in incimerating the contents and textures, acting on the residue with diluted nitric acid, aided by heat, adding an excess of ammonia, and transmitting sulphuretted hydrogen. The ammonia separates a yellowish precipitate of sesquioxide of iron, and does not render the liquid blue, if there be no copper. The sulphuretted hydrogen then produces black sulphuret of iron.

* *Cormack's Journal.*

CASES OF POISONING BY ŒNANTHE CROCATA.*

BY P. BOSSEY, ESQ.

TWENTY-ONE convicts were employed, on the 4th February, 1843, at the mortar-mill situated on the banks of a canal at the Royal Arsenal, Woolwich. At 11 o'clock in the forenoon, eight or ten of them went round the building to an adjacent pond of water, in order to wash their spades and boots. One man (Chamberlaine), strayed away from the rest, and found this plant growing near the

* From *The Medical Gazette.*

brink of the canal, the leaves and roots of which he mistook for celery. He dug up some, washed, tasted, and conveyed it to his companions. Several of the men returned to the spot, assisted him to obtain more of the roots, ate them freely, and distributed portions among their fellow-workmen who remained within the building.

At 20 minutes past 11, under the direction of the keeper, they were all about to fall into ranks for the purpose of returning on board-ship to dinner (most of them still eating and putting roots into their pockets), when one (Wilkinson), without any apparent warning, fell down in strong convulsions. The struggling was soon over; he became better, but retained a wild expression in the countenance, which was pale, and in a short time he had another fit. Whilst they laid him upon a shutter, a second individual fell (Knight), and before they reached the yard adjoining the hulk, a third (Wilson), and a fourth (Salt), had also fallen, and were convulsed.

I arrived to give assistance about a quarter before 12 o'clock. Nine stout young men were at this time convulsed and insensible. The three worst, Wilkinson, Knight, and Wilson, were lying in a shed; Chamberlaine, Gundle, and Jeffs, had just fallen in the yard; and Williams, Jones, and Salt were struggling on the deck of the vessel.

It was manifest that Wilkinson was dying. His bloated livid face, the sanguineous foam about the mouth and nostrils, the stertorous snort and convulsive breathing, and the extreme prostration and insensibility, plainly indicated that every remedial measure would be useless. Nothing was done but to raise the head and shoulders, and he died in five minutes.

Knight had been strongly and repeatedly convulsed, and appeared to be fast hastening into the same apoplectic condition. He was insensible, speechless, the pupils dilated, the face swollen and livid, the breathing labored, and the limbs convulsed. To make him swallow was impossible; the rigid jaws were therefore forced asunder, and, by means of the stomach-pump warm water was abundantly introduced and withdrawn from the stomach. Some leaves were extracted with the fluids, but the instrument was worked with the greatest difficulty, owing to the severity of the convulsions. He died in a quarter of an hour.

Wilson had assisted to carry the two former: when near the yard he was observed to look pale, and soon fell convulsed. He struggled so violently, that several strong men could scarcely hold him. After the fit he was restless; consciousness partly returned; he answered "yes" when his name was loudly called, and swallowed an emetic solution of sulphate of copper. No vomitting was induced; the convulsions were renewed; the stomach-pump was passed, but extracted only fluids. A collapse, threatening immediate dissolution, followed; his strength was gone, face pale, pupils dilated, breathing convulsive, and he appeared dying. After some time the stomach-pump was again employed, and small portions of the root, with a few leaves, withdrawn. Convulsions returned, with strong struggling, and about half-past 12 o'clock, in a fit, he suddenly died.

Emetics of salt and mustard, with warm water, were administered to those who had fallen in the yard, under which they vomited freely, and discharged a large quantity of imperfectly masticated root, and were thereby greatly relieved. The convulsions ceased, sensation and reason were restored, but there remained giddiness, pallor of the face, dilated pupils, coldness of the extremities, much weakness, severe rigors, and a slow feeble pulse. Further vomiting was promoted, and more of the root discharged. Friction and warmth were applied to the extremities, whilst ammonia and rum with thin gruel and other drinks were administered internally till reaction was more fully established.

Emetic doses of the sulphates of zinc and copper, and also mustard and water, were given without effect to the patients lying on the deck of the vessel. They were also bled very largely, both from the arms and jugular veins. The introduction into, and removal of warm water from, the stomach by the pump, brought away small portions of the noxious roots. Cold affusion upon the head, perseveringly used, lessened the struggling, and produced some exhaustion. In three cases (Salt, Williams, and Burgess), the subsequent fits became less violent; they passed into a state of maniacal delirium, with much jactitation of the limbs, and after some hours were removed into the hospital. But in one more patient (Jones), all these remedies were ineffectual: he died convulsed at a quarter before 1 o'clock. As a last effort, the trachea was carefully opened by an incision, and artificial respiration kept up, but life was quite extinct.

Several of the men who had eaten the root, seeing the others suffer, took the salt-water emetic with success, and had no symptoms of being poisoned; others felt giddiness and faintness in a slight degree, and at 6 P.M. there were upon examination eleven who required watching, and were therefore sent into hospital.

Extracts from Notes of Cases in Hospital.

Feb. 4th.—Jeremiah Chamberlaine, æt. 21,

admitted at 6 P.M. in slight stupor; countenance anxious, depressed; is drowsy; the eyelids half closed; pupils dilated; tongue clean; skin cool; slow pulse. Took a purging draught, and an enema of salts and senna, which produced two motions, the first principally the injection; the second, copious, fluid, brown, and mixed with white root, resembling what they had eaten.

Purgatives repeated, with magnesia.

10 P.M.—No motion; countenance improved; sleeping.

5th, 1 A.M.—Is sick, and looks worse; countenance anxious and sunken; pupils dilated; the hands and face feel warmer; complains of pain in his chest and abdomen, the latter is hard and tender; no further motion; tongue clean; pulse feeble; seems weaker.

Ordered ammonia, &c.

3 A.M.—Is warmer; pulse stronger; sleeping. Bowels once opened.

10 A.M.—Countenance improved; mouth dry and parched; thirst; tongue slightly coated; tenderness, hardness, and pain in the abdomen; no further motion; no urine since midnight.

Purgatives continued.

4 P.M.—A sudden distension of the abdomen, with shortness of breathing; pulse 66; lies in a perfectly relaxed position; pupils dilated; no pain or headache, and no motion.

Purgatives and enemata repeated, with assafœtida.

Midnight.—Has passed one motion, copious, fluid, dark brown in color, with pieces of the root discernible. No abdominal pain; urine thick, and dark colored.

6th, 8 A.M.—Is much better. Abdominal swelling and tenderness gone.

4 P.M.—Tongue white; pupils natural; urine plentiful, dark in color, with a thick yellowish sediment; had three motions similar in character.

7th.—Tongue white, red at the edges, but recovering.

8th.—Pain in the head; bowels confined; tongue cleaner; urine free, dark colored, with sediment. Took castor oil, which produced one copious fluid motion, yellow in color, and in which the root can still be seen.

17th.—Discharged, recovered.

Abel Burgess: first fell convulsed on the deck of the vessel; was bled very largely, had emetics, the cold affusion, the stomach-pump, and subsequently stimulents.

Feb. 4th, 6 P.M.—Still slightly collapsed; loud rattles in the trachea; countenance anxious, depressed; complained of pain in his breast; breathing short; tongue swollen.

Ordered a strong cathartic, and an enema of salts and senna, with occasional doses of ammonia.

10 P.M.—Countenance improved; is warmer; the pain is more severe in the right side; the rattles in the throat louder.

Ordered a mustard-poultice, and as before.

Midnight.—The pulse stronger; pain in the head; more restless; breathing short. On admission he passed a natural motion. None since.

5th, 10 A.M.—Feels better; pain in the head; slight pain in the right side; tongue clean, swollen; the rattles still heard. At 4 A.M. he had two motions, both of which contained much of the root.

Noon.—Is hot and feverish; the respiration hurried; pulse frequent and feeble; still complains of pain in the side; pain in chest gone; tongue red at the tip.

4 P.M.—Face swollen, flushed; eyes injected; pupils natural; tongue moist, clean; much mucus in the throat; coughs slightly, and expectorates with difficulty a reddish mucus; the cough gives pain in the region of the liver and in the head; pulse full, 120; thirst; abdomen soft, without tenderness; semipriapism. Passed a pint of urine, reddish, and depositing a copious white sediment; feet warm; the bowels not moved since morning.

Repeated the enema.

6th, 8 A.M.—Bowels have acted, and he feels better, but still has pain in the head and right side; respiration hurried; slight rattling in the trachea; urine reddish.

8 P.M.—Respiration less hurried, but coughs more; rattling in the throat declining; expectorates a thick reddish mucus; pain in the side; urine thick, highly colored; had two fluid motions.

Ordered castor-oil, and to take calomel every three hours.

7th, 8 A.M.—Passed a good night; four motions, partly bilious; abdomen free from tenderness; expectoration bloody; pulse frequent, soft; tongue white; skin warm; the rattles gone.

Continue calomel, &c.

6 P.M.—Breathing short and hurried; pulse 120; cough increased.

Bled to 10 oz., and continued the calomel.

8th, 8 AM.—Has passed more of the root; breathing easier; cough and expectoration as before; tongue clean; urine dark in color, with sediment; slight rattling heard this morning.

Antimonial mixture, &c.

1 P.M.—Has passed another motion containing some root; pulse 108, soft; on the right side of the chest there is dulness on percussion, the natural murmur wanting; a short bronchial sound on the left side; sonorous rattles; the hearts's action quick, weak, with a thrilling sensation communi-

cated to the hand; tongue white; face flushed.

The bleeding repeated. Pergat cæteris.

6. P.M.—Breathing with more ease, but the right side still painful.

9th, 8 A.M.—Breathing easier; cough less; tongue clean; countenance improved; sputum less bloody; face not flushed; thirst gone; is very weak; there is great tenderness on the right side; has had one motion, thin, yellow in color, mixed with black or dark brown specks, the remains of the root.

Ordered saline mixture every four hours.

10th.—Tongue moist; skin cooler; pulse soft, 90; breathing short; cough troublesome; sputum dark, but not so bloody; still a little pain in the right side; bowels not open.

Ordered castor oil, and a blister to chest.

10 P.M.—Cough distressing; breathing short; tongue coated, moist; exporates a less bloody mucus; moans considerably.

Ordered antimonial mixture every two hours.

11th.—Breathing short and difficult, especially when he is moved; cough troublesome; tongue clean, moist; skin not so hot; sputum less bloody; had nine motions during the night.

Suspend the antimony; gave him a cordial draught and salines.

12th, 10 A.M.—Breathing easier; cough troublesome; expectoration copious; a pain in the right side; tongue clean, moist; abdomen tender; had four motions.

Ordered 1 grain of calomel every three hours.

13th, 10 P.M.—Breathing more oppressed and difficult; countenance anxious; is restless, endeavouring to get up; face a little flushed; tongue clean and moist; is drowsy; the pain in the right side has increased; expectoration very copious, loose, and less bloody; urine plentiful and still thick; had two bilious motions in the night; feels himself worse.

Ordered to continue the calomel and a blister.

8 P.M.—The cough and breathing easier; countenance improved; expectoration easy, and becoming white; has passed three bilious motions.—Pergat.

14th, 10 A.M.—Is worse; breathing more difficult; pulse feeble; features anxious; expectoration easy and copious; rattling in the trachea; tongue clean, moist; had one motion, dark and bilious.

Ordered wine and sago, and to continue the calomel.

6 P.M.—Approaching delirium; restless; pulse very small and feeble; breathing short; countenance anxious; had three motions during the day, dark and greenish.

Ordered ammonia and stimulants.

10 P.M.—Appears to be fast sinking; the countenance pallid; eyes half closed; cannot lie down; mucous rattles in the trachea; expectorates with great difficulty.

Ammonia and wine freely.

Midnight.—Still sensible; much weaker; rattles louder; breathing shorter.

15th.—Sat up in bed till half past 2 A.M., when he laid back on his pillow, and instantly died quite easy.

On examination of the body there was found a considerable development of the papillæ at the root of the tongue, and of the mucous follicles throughout the œsophagus, stomach, and intestines. The surface of the mucous membrane was lined with a tenacious secretion, which, being washed away, presented the membrane itself, thickened, softened, and more than usually vascular.

The lining membrane of the trachea and bronchi was deeply injected, the smaller tubes being choked with a frothy bloody mucus. The lower portion of the right lung in the state of red hepatization. Both lungs were heavy, contained much blood, and interspersed throughout their substance, but especially in the right, were various spots of ecchymosis from extravasated blood—probably effused during the primary convulsions.

The right pleura was adherent and lined with the products of recent inflammation; and in the back of its cavity there was considerable serous effusion lying upon a surface covered with fibrinous lymph of a pale straw color.

The pericardium was largely distended with a greenish colored serum.

The vessels of the pia mater were fuller than usual. The brain was not unhealthy; it presented rather more bloody points, and there was also slight serous effusion.

In this, and the former patient, the tremendous shock which the powers of life had sustained by the first direct operation of the poison, and probably its continued influence in proportion as it was digested in the body, appeared to render the state of reaction one of peculiar irritability and danger. There was a tendency to swooning and collapse; a variableness in the condition of the pulse, the respiration, countenance, and temperature, that seemed to prohibit further depletion till two or three days had elapsed; and the local inflammations which successively arose in different organs were not afterwards controlled by the liberal use of the ordinary remedies.

The remaining patients did not suffer any urgent symptoms: under the free use of

purgatives they passed considerable quantities of the root, and were in a few days discharged.

Examination of Wilkinson (*No.* 1) 47 *hours after death.*

The appearance of the body very stout and muscular; extremely rigid; the fingers stubbornly contracted; the thumbs turned in upon the palm; the nails blueish. General lividity, not very intense, but in patches anteriorly, while the whole dorsal surface presented a deep purple hue, except in the hams, where the hue was redder, and on the parts subjected to pressure, as the scapulæ and nates, over which it was absent. The scrotum and penis slightly livid; the former not distended.

The countenance livid, somewhat swollen, especially beneath the jaw; the eyelids somewhat open: conjunctivæ slightly congested above and laterally; slight opacity of the cornea; the pupils dilated, the irides being about a line in breadth; the lips, gums, and ears purple; a frothy secretion filled the nostrils; the tongue bitten at the tip, with an appearance of blood between the teeth.

The chest flattened, contracted above, duller than usual on percussion; there was unusual distension and resonance of the abdomen, especially in the epigastric region.

On dividing the scalp, fluid blood escaped more freely than usual; the pericranium natural; the skull very thick: on the interior of the skull were a few injected veins; the dura-matral surface was thought to be not much injected; the longitudinal sinus contained only fluid blood, not the slightest trace of a coagulum. The veins of the pia mater had a natural appearance; they certainly were not distended, as they did not reach a level with the top of the convolutions. Not more than the usual quantity of blood in the sinuses, but it was of a very black color and perfectly fluid. There was a slight degree of serous effusion, a clear gelatinous deposit under the arachnoid, and some globules of air were seen in the veins. The processes of pia mater dipping between the convolutions were darker than usual; the plexus choroides also darker, being of a plum or damson colour. The cortical structure of the cerebrum was not redder than is usual in recent brains; more bloody points were seen in the centrum ovale; no serum in the ventricles; some veins were ramifying on the corpora striata; the substance of the corpora and thalami were thought to be slightly redder than usual. The veins and sinuses beneath the posterior lobes of the cerebrum were fuller; the veins on the pons varolii, the medulla oblongata, and about the roots of the nerves, turgid. The substance of the cerebellum, pons, and medulla, was somewhat redder than usual. On dividing the veins and arteries of the spinal marrow, a quantity of fluid blood flowed into the base of the skull. No water at the base.

The veins beneath the integuments of the back were congested. On opening the vertebral canal the theca spinalis had a reddened appearance; the vertebral vessels were injected; the veins and sinuses filled with black fluid blood; the substance of the spinal marrow, especially its internal structure, redder than usual; at the lowest portion, in the lumbar region, there was a little serum.

The tongue was large, and covered with a white fur; the papillæ at the base remarkably elevated and vascular; the soft palate, tonsils, and pharynx, covered with a glairy mucus, and presenting a general blush of dull and somewhat livid vascularity, deepest in those parts where the fluid gravitated, as in the little cavities between the epiglottis and the tongue. The epiglottis dull, with vascular lividity, turgid veins being seen upon it. The pharynx and œsophagus had a white appearance, contained some mucus, had portions of the root.

The trachea and bronchi were lessened in diameter, appearing contracted, and the lining membrane intensely injected with dark blood. This injection was party concealed by a thick smearing of reddish mucus, which also filled up the smaller bronchial tubes. The lungs were purple and heavy, being gorged with fluid blood; and there were several recent small extravasations of blood scattered through their substance.

The stomach and intestines externally were pink in color and distended with air; the stomach also contained a little fluid, some of the root, and was, with the intestines, every where lined with a thick viscid mucus. The mucous membrane was thrown into folds, forming prominent ridges, intersecting each other like meshes. After washing away the mucus, when the membrane was placed under water its surface had a mamillated appearance, the follicles being particularly distinct, erect, and abundant. Held up before the light, the pink colour of the tunics deepened by the action of the atmosphere upon the dark blood in the vessels; there were also minute points of extravasation, and dark lines in the course of the venous trunks.

There was a great deal of mucus, and minute portions of the root in the small intestines, especially in the lower part of the ilium.

The state of the heart was natural, but

the blood found in it, and also in the great vessels, was very black and fluid.

No trace of decomposition had occurred.

The second body examined was that of Peter Knight (No. 2), which presented similar external appearances, and was thought to be equally livid, but had somewhat less muscular rigidity.

A greater quantity of blood than is usual flowed from the incisions made in opening the head and spine. The principal abnormal circumstances noted on this inspection were the veins of the pia mater very much distended, causing extensive arborescence both on the surface and between the convolutions of the cerebrum. The plexus choroides had a dark damson colour, the velum interpositum much injected, and many vessels ramifying upon the corpora striata. The veins of the cerebellum, at the base of the brain, and the basillary veins, were also in an equal degree distended. The tentorium was extremely blue in colour, not from extravasation, but from great injection.

The substance of the brain in all its parts was more vascular, and exhibited more bloody points in the sections, as did also the pons varolii, medulla oblongata, and spinal marrow. The roots of the nerves were also red from injection; the sinuses of the spinal marrow gorged. About two drachms of serum in the ventricles; four drachms were collected at the base; and there was also general, but not great, effusion under the arachnoid.

A slight contusion on the soft palate had resulted from the passage of the stomach-tube, but the whole of the throat, the root of the tongue, the glottis, and epiglottis, were much reddened; the follicles at the base of the tongue were particularly large and prominent. The œsophagus reddened through its full extent; at the lower end the cuticular lining with its fimbriated edge particularly evident.

The glottis and sacculus laryngis were lined with frothy mucus; the trachea most intensely injected of a deep purple almost black color. The bronchi were similar in color, and plugged by mucus. The lungs were very dark, extremely congested, and in many places apoplectic effusions had occurred.

The peritoneal coat of the stomach had a pink color, especially intense about the cardiac orifice. Large black veins were running along its lesser curvature, and branching down its sides. The mucous membrane thickened thrown into large rugæ follicles prominent with vascular apices, and of a pinkish color, pylorus contracted: there was much extremely viscid mucus strongly adherent. The state of the intestines similar to that described in the last case.

The body of Wilson (No.3) was also examined, and we noted in the head and spine the same appearances.

In the mouth and throat, the papillæ of the tongue remarkably enlarged. In the fauces, pharynx, and larynx, a remarkable vascular lividity, most intense about the epiglottis and soft palate. The sacculus laryngis and trachea contained frothy mucus; the lining membrane of the trachea also highly congested, thickened, and presenting the same characteristic, though rather less distinct, appearances than the others.

There was an accidental effusion of blood behind the œsophagus, and between its tunics at the lower part. The stomach contained a pint of turbid fluid, with some portion of the masticated root. The stomach and intestines both exhibited the same pink color externally. The bronchi were likewise congested. The lungs were extremely livid; fluid blood and serum freely flowed from every incision. In some parts the congestion was as great as in cases of pulmonary apoplexy. The follicles in the œsophagus and stomach very distinct. There was a large quantity of viscid mucus in the stomach, especially near the pylorus.

The only difference noted on the inspection of the body of Jones was the presence of a layer of extravasated fluid blood beneath the pia mater covering both hemispheres of the cerebrum. The color of the membranes was quite blue. The effects upon the other organs were quite answerable to those already related in the other cases.

From what has been related, it appears that the effects which the œnanthe produced in these cases were a violent irritation of the mucous membrane of the œsophagus and stomach, more particularly of the follicular structures, and a state of severe and universal spasm of the muscular tissues; it also induced insensibility, coma, delirium, extreme congestions of internal organs, and, in those cases immediately fatal, it occasioned permanent fluidity of the blood.

The first indication of treatment was doubtless to evacuate the stomach; but, as its sensibility was destroyed, and the poison was taken in the solid form, this could not readily be accomplished. Large and immediate depletion seemed to be essentially useful, by removing the imminent danger of extravasation from over-distension of the vessels; the cold affusion was also beneficial in rousing the patient, so as to make him sensible to the emetics, and so were purgatives during the after-treatment.

Called thus, in a moment, to so many

urgent cases of poisoning, it became needful to use such remedies as were at hand; but, upon reflection, it seems to me proper, in similar circumstances, to rely chiefly on emetics given early, on large blood-letting immediately employed, and the cold affusion.

Although the attempt to re-establish respiration by tracheotomy failed in the case selected for it, in consequence, probably, of the great effusion of blood afterwards found on both hemispheres of the brain, yet it is worthy of a future trial in single cases, where it can be more conveniently practised.

Considering the great activity of this poison, that it is capable, as we have seen, of extinguishing the life of a strong young man, in full health, in one hour, and that many other fatal cases are recorded, it is rather singular that the nature of the active principle of the œnanthe is not yet well known, or the plant applied to medicinal use.

ON THE EMPLOYMENT OF CASTOR SEEDS.*

BY DR. MIALHE.

Castor oil, says M. Soubeiran, is less purgative than the seeds which furnish it. This is because the oil which flows out in the press contains, comparatively, less resin than remains in the residue.

M. Mialhe relates various therapeutical results obtained by means of an emulsion, prepared with fresh seeds of castor, which entirely confirmed this opinion; for. with 10 grammes of seeds deprived of their shells, there was an emeto-cathartic effect, which continued for three days, neither opiates, cold gaseous drinks, nor cataplasms being able to subdue it. An emulsion prepared with 6 grammes, produced 28 vomitings, and 18 alvine evacuations.

Finally, with a third emulsion, containing only 1 gr. of castor seeds, the emeto-cathartic effects was still very powerful.

From these facts M. Mialhe concludes:—

1st. That the oleoresinous principle found by M. Soubeiran in castor seed exists only in very small proportion in the oil of these seeds, whilst the whole of it was found in their emulsion.

2nd. That French castor contains a large proportion of the acrid emeto-cathartic principle belonging to a great number of plants of the *Euphorbiaceæ*.

3rd. That the emulsion of castor seeds, prepared with only 20, 30, or 50 centigrammes of these seeds, constitutes, perhaps, the most agreeable purgative of all those at present in use (if, however, the vomitive effect of this emulsion completely ceases when the dose of seed is suitably diminished.

Although this latter peculiarity has not yet been proved by clinical observation, it is probable that it is the case; for it is almost certain that the active principle of castor is analogous to, if not identical with, that of croton oil. Now, it is known that this latter oil, which is a simple purgative in the dose of 1 drop, becomes emeto-cathartic when this small dose is exceeded.

* *Bullitin de Thérapeutique.*

NEW SPARADRAP OF OPIUM.*

To prepare this sparadrap, which presents to the therapeutist a medicament of much more certain effect than the compositions in which the active principle is associated with a fatty body, serré and thick black taffity is stretched on a board by means of small nails.

Then, by means of a brush, there is spread on this taffity three successive layers of gummy extract of opium, to which has been added one-sixth of its weight of very finely-powdered gum arabic, and sufficient water to give to the mixture the consistence of a very thick syrup.

When the third layer has been applied, and is very dry, the taffity thus prepared is detached, and kept in a place free from damp.

There is no doubt that we may prepare, with equal advantage, medicinal taffities with the extracts of certain plants possessed of great activity, such, for example, as belladonna, stramonium, tobacco, cicuta, aconite, digitalis, &c.

ANTIPERIODIC OINTMENT.†

℞—Lard	95	gr.
Sulphate of quinine	15	,,
Sesquioxide of iron	60	centi-gr.
Pure opium	15	,,

Use.—In frictions on the vertebral region, after having washed it with soap and water, every two hours for three days.

This ointment is employed in cases of periodic fevers—when children are indisposed for absorption—when the fits do not allow time for administering the preparations of quinine—when there is vomiting and dysphagia, &c.

* *Journal de Connaissances Médicale.*

† *Journal de Chimie Médicale*, July, 1844

IV. REVIEWS AND NOTICES OF BOOKS, &c.

AN ESSAY ON THE CONSTITUTION OF THE EARTH. London: Houlston and Stoneman, Paternoster Row, 1844. 83 pp. 12mo.

Of this work we shall not express an opinion, as it is not altogether within our province; but, in order to give our readers an idea of its nature, we will let the author speak for himself:—

"The intention of this Essay is to show that the earth has derived its existence from the sun, and that it has attained its present relationship thereto in the course of countless millions of ages; during which time, it has been slowly increasing in size, and, in every other respect, assuming its present condition in a gradual, progressive manner: leading to the conclusion that it, as well as the other planets, may ultimately attain a position amongst the stars as important as the sun itself; becoming the foundation to other systems."

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Hutchinson—On the Drainage of Lands. 8vo., 10s. cl.

Sproule (J.)—Essay on the Growth and Management of Flax in Ireland, which obtained the Gold Medal of the Royal Dublin Society. 8vo., sewed, 1s.

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Pidgeon (E.)—Fossil Remains of the Animal Kingdom. 2nd ed. 8vo., 18s.

Graham (R. H.)—Graefenberg; or, a True Report of the Water Cure: with an Account of its Antiquity. 8vo., 6s. cl.

DEATH OF DR. DALTON.

We are sorry to announce to our readers the demise of this celebrated chemist and philosopher, who departed this life on Saturday morning, the 27th instant, in the 78th year of his age.

THE ADELAIDE GALLERY.

We have lately paid a visit to this institution, and were well satisfied with the various entertainments with which we met in the course of our sojourn there. The scientific lectures of Mr. Maugham are varied, and highly interesting; as also the discourses on electricity, magnetism, and the miscroscope. There are also to be seen here two fine specimens of the *Gymnotus electricus*, or electrical eel, which are said to be the only living specimens in Europe. After having become instructed by an insight into the various works of art, as well as the numerous scientific apparatus, &c., the visitant is gratified by a sudden and agreeable change, in the shape of a most delightful concert, which acts as a relief to the comparative monotony of a truly scientific exhibition. Nor is the *buffa* singing of Mr. Trenklee to be forgotten, for we can assure our readers that we were highly entertained by that exceedingly clever performer. We trust that our readers will forgive us for thus far outstripping the usual bounds, but we assure them that they will do well, when opportunity affords, to pass a quiet evening at the Adelaide Gallery.

EXPLOSIVE FORCES.

[We need offer no excuse for reprinting the following from the columns of the *Morning Post*, although it does not appear under its proper division.]

The experiment so successfully performed off Brighton by Captain Warner having publicly demonstrated the destructive action of the secret power which he has under his control, it may be interesting to examine the nature of known explosive forces, and to investigate the principles on which their

effects depend. In pursuing investigation of this kind, however, much uncertainty prevails, arising from the difficulty and danger of experimenting with explosive compounds, the energy of which is suddenly excited, and depends in a great degree on the intensity of the action.

The explosive force of gunpowder, it has been well ascertained, depends on the sudden generation of an elastic gas from the fired powder. The quantity of gas generated from a given quantity of gunpowder may be measured with tolerable accuracy; therefore it might be supposed that its explosive force could be ascertained with equal certainty. But, independently of the gas generated, the expansion of the gas at the instant of its generation has to be taken into account; and in forming this estimate the greatest variations of opinion have existed among "good authorities." It has been ascertained by careful experiments that the quantity of gas generated on firing the gunpowder manufactured at the Government mills, occupies 244 times the space of the powder; that is, one cubic inch of gunpowder produces 244 cubic inches of gas. Therefore, if that quantity of gas could be compressed within a space of one cubic inch it would exert an elastic force equal to that of 244 atmospheres, or 3,660 pounds on the square inch. But assuming the heat of fired gunpowder to be equal to that of a red hot fire, the gas would be expanded from 244 cubic inches into 1,000, and the pressure at the instant of firing would be equal to six tons on the square inch. The degree of heat must depend materially on the quantity fired, and so great have been the differences of scientific men in their estimates of the force of gunpowder, that whilst Mr. Robins estimated it at 1,000 atmospheres, Dr. Hutton calculated it at 2,000 atmospheres. And the celebrated Count Rumford carried his estimates as high as 54,000 atmospheres. We believe that the estimate of Dr. Hutton is now considered to be nearly correct, that the explosive force of gunpowder when fired is equal to a force of 2,000 atmospheres, exerted within the space occupied by the powder.

Prodigious as this power of gunpowder seems, it is not greater than that exerted by an equal quantity of water when converted into steam. One cubic inch of *fired water* would generate steam sufficient to produce an equal amount of steady pressure. The greater destructive effects of the gunpowder depends not on the greater amount of actual force exerted, but on the greater rapidity of its action. The difference in this respect is similar to that between pressure and percussion; a piece of glass may bear a pressure of tons, yet be shattered to pieces by a smart blow of not greater force than a few ounces.

The intensity of action produces more destructive effects than absolute amount of power. It is on this principle we may account for the destructive effects of fulminating mixtures, and other inflammable compounds. In the course of some experiments we instituted for the purpose of ascertaining the propulsive effort of an explosive mixture of oxygen and hydrogen gases, we ascertained that under the most favourable circumstances the force generated did not exceed ten atmospheres, yet judging from the minute particles into which glass was shattered by its explosive action, we are induced to believe that the intensity of the force must be greater than that of gunpowder.

The loud report made by most fulminating compounds shows that the intensity of their action must far surpass that of gunpowder. The cause of the report is the sudden displacement of the air by the gas generated during inflammation of the compounds. This is so rapid that the gases produced by the rapid chemical union of the elements of the substance strikes the air with as much violence as does gunpowder when rammed into a cannon. The vast difference in the efforts exerted by gunpowder and by fulminating mixtures is evidenced by firing them when unconfined. An ounce of gunpowder will scarcely make any report, whilst a few grains of fulminating silver gives a report like a pistol. The effects of such fulminating mixtures show also the far greater intensity of their efforts. When gunpowder is fired unconfined, a large quantity is required to produce any effect. It was the practice during the recent war in India for our soldiers to blow open the gates of towns by firing bags of gunpowder, but nothing less than many pounds could generate sufficient explosive force. The effect in such cases must be produced by the reaction of the air, for the explosive force would be dissipated in the atmosphere if its action were not so great and so sudden as to meet with resistance from the air, which constitutes the *point d'appui* whereon the force acts in the opposite direction. When unconfined fulminating mercury is exploded it obtains this *point d'appui* on the air by the greater intensity of its action when the quantities are grains instead of pounds. It is for this reason that the effort of fulminating mercury is observed to be directed downwards when fired on a table. The resistance of the air above serves as its *point d'appuis*, and enables it to penetrate into the substance of the resisting body underneath.

A much more formidable compound than the fulminating preparations of the metals is the chloride of nitrogen, which was discovered in 1812 by M. Dulong the French chemist, and its nature was investigated by the late Sir Humphrey Davy. This substance is an oily liquid, and the most minute drop exploded on the point of a knife will shatter the blade to pieces with a loud report. Its effects were recently exhibited by Professor Faraday during a lecture at the Royal Institution, when a very small drop on the centre of a plate was exploded, and broke the porcelain into pieces. This compound explodes on the slightest concussion; by throwing a drop into olive oil, or by touching it with phosphoros, an explosion immediately ensued.

Compared with such fulminating compounds, the force of gunpowder seems feeble. We are not aware of any attempt having been made to apply them as projectile forces, nor as explosive agents; but from the experience of their action in small quantities there can be little doubt that the percussive effects of fulminating mercury, or of chloride of nitrogen, would be as superior to those of gunpowder, as the latter is superior to steam as a percussive agent. It is not improbable that a shell charged with either of those compounds would produce effects equally as destructive as the agent employed by Captain Warner, but hitherto the danger of the manipulation has prevented many experiments of the kind from being made. It is not, therefore, so much the magnitude of the force exerted as the mode of safely controlling it in which the merit of Captain Warner's invention depends. Forces far more destructive than gunpowder have been long known, but they have remained useless from the difficulty of their application. If Captain Warner has overcome this difficulty, even supposing the force employed not to be new, he will have succeeded as effectually in changing the art of war as did the inventor of gunpowder.

TO CORRESPONDENTS.

"R. M." will observe that we have complied with his request.

"A Subscriber."—Two guineas thrown away.

"An Inquirer."—Marsh's test.

"X. Y. Z." (Cheltenham).—Have the goodness to send your name and address, in order that we may communicate with you privately.

"D. A." (St. Petersburg.)—Brande's *Manual of Chemistry*.

"Alpha."—We do not know them, but will make inquiries for you.

"A Member of the Pharmaceutical Society" is recommended to put his question concerning the utility of that Society to the Secretary, or Mr. Jacob Bell.

Several Members of the Pharmaceutical Society have written to us during the past month, requesting our interference. The Society is fast finding its level.

Numerous correspondents answered by post.

SUMMARY OF METEOROLOGICAL OBSERVATIONS MADE AT OTLEY, YORKSHIRE, IN JUNE, 1844.

BY E. THOMPSON.

BAROMETER.

Monthly mean	29·72
Mean at 9 a.m.	29·69
,, at 3 p.m.	29·72
,, at 9 p.m.	29·75
Maximum on 11th	30·02
Minimum on 6th	29·47
Range	·55

THERMOMETER.

Monthly mean	54°
Mean of maxima	67
,, minima	47
Maximum on 13th	70
Minimum on 4th	41
Range	29

Rain.—1·88 inches.

WIND.

Days.		Days.	
N.	2	S.	0
N.E.	4	S. W.	8
E.	2	W.	9
S. E.	0	N. W.	0

WEATHER.

	Days.		Days
Clear	0	Rain	5
Cloudy	19	Hail	0
Overcast	3	Thunder	4
Showers	6	Lightning	2

GENERAL REMARKS.

The first half of the month was a continuation of the uninterrupted drought which lasted nearly three months. On the 17th copious showers fell, which were followed by others at intervals; and on the 24th there was a tremendous storm of thunder and lightning, continuing for nearly the whole day.

Nota Bene.—*All Communications, Books for Review, and Substances to be Analysed, must be addressed "To the Editors of the Chemist, 310, Strand, London." Communications must be prepaid, and sent before the 15th of each month; Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

ON THE CONSTITUTION OF SALINE BODIES, WITH SOME REMARKS ON DR. HARE'S VIEWS OF THE SUBJECT.

BY REUBEN PHILLIPS.

In the July number of The Chemist, Dr. Hare quotes the following paragraph:—"During the electrolysis of water, and such like simple combinations, it may be conceived that oxygen is liberated on the anode, while the hydrogen passes on to the cathode; or the hydrogen may be first produced on the cathode, and the oxygen may pass on from molecule to molecule to the anode; or both effects may be simultaneously produced." He then proceeds to say—"In the first place, I deny that any one of Mr. Phillips's cases can occur; I deny that either hydrogen or oxygen, or both, can correctly be said to pass from one electrode to the other. At all events, there is no necessity for this species of locomotion." Then follows the ordinary explanation of the action, which I then did, and do now, consider as most *probably* true; but it is manifestly incapable of proof, and as I was only dealing with the *results* of the electrolytic action, it was best not to embarrass the subject with such doubtful considerations; however, I alluded to the hypothesis when I said that oxygen may pass on from molecule to molecule to the anode.

"It is remarkable," observes Dr. Hare, "that, after admitting that the rationale which I have given is consistent with one of his imaginary cases, Mr. Phillips should consider it an objection that it would not comport with two other cases which, by his premises, may never exist."

I never considered it an objection to Dr. Hare's theory that it would not comport with all three cases, until it was shown that the former case is untrue, as the following quotation will show:—"Here, then, Dr. Hare's theory fails to be so comprehensive as the one advocated in this country, for it requires the additional assumption that the first case is the true one. *But certainly this can be considered as not at all justifying us in rejecting it as untrue.*" That is, according to the data given in the preceding portion of the paper from which the quotation is made, for it is subsequently shown that the first case is not true. The words, "which, by his premises, may never exist," contain an ambiguity; and I can only say of them, that I do not see how it is possible to imagine other than that one of the three cases must exist. Recollect, I pay no regard to the manner in which the effects may be conceived to be produced, but only to the visible results.

Dr. Hare says—"As to my theory not embracing the fact of the '*transfer of acid and alkali*,' I have shown in my letter to Professor Daniell, published in the *Philosophical Magazine and Journal* in August last, that agreeably to neither theory should there be any such transfer." That there is such a transfer is a fact which Dr. Hare admits Professor Daniell to have proved, and hence Dr. Hare admits the falsity of his own theory; but, what is more unaccountable, he cannot see the truth of the other.

I would remind Dr. Hare that the transfer for which I am contending differs from the transfer to which he alludes, when he says that "the electrolytic process, agreeably to Faraday, does not cause any transfer."

If there be any obliquity in the facts of which I have availed myself, let the blame attach to Kane, Graham, Daniell, and others, who referred either to the same or analogous facts, in the first instance, as forming a basis for a series of arguments in favor of the existence of salt radicals. "Referring to the same, or to analogous facts, I have endeavored to counteract these arguments," observes Dr. Hare. This exactly coincides with the opinion I had previously formed of these arguments, that they contain nothing new, and that they have been long known to chemists; and hence the force of my remark, that the arguments for and against may be regarded as equal, seeing that no chemist could *positively* say on which side the truth lay.

"But to narrow the question, I request Mr. Phillips to show," &c. It is strange

that Dr. Hare should ask me this question. All I can say is, that I am unable to draw the line of demarcation between these bodies any better now than I was when I wrote, "that it is impossible to draw the line of demarcation between the oxides, chlorides, sulphates, &c. Therefore I think that, if the term salt be retained, its definition will be—any electrolyte, or any body on which we could confer fluidity, would be an electrolyte."

ON SUCCINIC ACID AND ITS COMBINATIONS.*

BY PROFESSOR FEHLING.

1. COMPOSITION OF THE SUCCINATES.

Succinic acid has already been the object of numerous investigations: M. Felix D'Arcet, especially, has determined the composition of this acid in the anhydrous and hydrated states; and, according to this chemist, the formula $C^4 H^2 O^3 + HO$ is admitted for the crystallised acid, and that of $C^4 H^2 O^3$ for the anhydrous acid. It is possible to obtain it isolated in the state in which it exists in the anhydrous salts, a property not possessed by the other acids.

Professor Fehling, who was formerly occupied with the study of this interesting acid, determined on resuming it. The acid which he used was the succinic acid of commerce, obtained by sublimation, purified by solution in concentrated nitric acid, and freed from musky odor by several crystallisations in alcohol. He ascertained its purity by elementary analysis.

The bases, especially the alkalis, were determined in the state of sulphates. For this purpose, he put the salt to be examined into a platinum crucible, with alcohol and an excess of sulphuric acid; then he heated the lid to redness, by means of a blowpipe and spirit-lamp, until the mass was dry and white. When necessary, he treated it a second time in the same manner, and finally heated it very strongly with an argand spirit-lamp, in order to drive off the excess of sulphuric acid and all the water. With certain salts it is as well to commence by reducing them to charcoal, then treating the latter by sulphuric acid.

SUCCINATES OF POTASSA.

The acid combines in several proportions with this base.

Neutral succinate of potassa, $2 (C^4 H^2 O^3 KO) + Aq$.

If a solution of succinic acid be saturated by pure carbonate of potassa, and if the neutral solution be evaporated, thin rhomboidal tables, resembling the crystals of chlorate of potassa, are obtained. This salt is very soluble in water, as well as in alcohol, provided that the latter be not too strong. It is unalterable in the air.

Acid succinate of potassa, $2 C^4 H^2 O^3, KO + HO$.

This salt, dried in the air, is anhydrous; it loses water only by prolonged heating, and at 212° F.

Super-acid succinate of potassa, $4 C^4 H^2 O^3, KO + 2 HO + 3 Aq$.

If the foregoing salt be dissolved in as much again of the acid as it already contains, the super-acid salt crystallises by cooling.

SUCCINATES OF SODA.

Neutral succinate of soda, $C^4 H^2 O^3, Na O + 6 Aq$.

This salt readily crystallises: the fundamental form of its crystals is an oblique rhomboidal prism, frequently contracted in the direction of one of the lateral axes, and then they appear tabular. Sometimes the crystals are more acute, without change in the composition. This salt effloresces only very slowly in the air.

Acid succinate of soda, $2 C^4 H^2 O^3, Na O + HO + 6 Aq$.

This acid-salt, prepared with the neutral salt, with the addition of acid, crystallises in tabular crystals, whose fundamental form is an oblique rhomboidal prism, contracted in the direction of the principal axis. These crystals are ordinarily large, and perfectly well formed. This salt slowly effloresces in the air, and then very speedily loses an equivalent of water of crystallisation equal to 4·5 per cent.

Succinate of ammonia, $C^4 H^2 O^3, N H^4 O$.

The author could obtain perfectly neutral succinate of ammonia only with the mother-liquors of the basic succinate of lead. Basic acetate of lead was precipitated by an excess of neutral succinate of ammonia. The first concentrated mother-liquors were evaporated, *in vacuó*, over sulphuric acid, and as soon as the mass was for the greater part crystallised, it was washed with a small quantity of water, in order to remove traces of lead—then pressed between leaves of paper, and dried at from 104° to 122° F.

SUCCINATE OF BARYTA, $C^4 H^2 O^3, Ba O$.

A dilute aqueous solution of chloride of barium is precipitated only at the end of some time by succinate of soda. There is then formed a granular crystalline precipitate, whose quantity increases as the liquor evaporates. The salt, when once formed, is very sparingly soluble in water.

* *Annalen der Chemie und Pharmacie.*

SUCCINATE OF LIME.

The neutral succinate of soda forms a precipitate only after some time, in even a very concentrated solution of chloride of calcium. This precipitate is produced more rapidly warm than cold : in the first case it is formed of very clear but small crystals ; in the latter it resembles more the pulverulent state. The quantity of water which these two precipitates contain is different, and depends entirely on the temperature at which the salt is formed. We obtain, according to the degree of temperature, $C^4 H^2 O^3 Ca O + 3$ Aq., or $C^4 H^2 O^3$, Ca O + Aq.

Acid succinate of lime, $2C^4 H^2 O^3 CaO$, HO + 2 Aq.

This salt is produced with a constant composition, when a solution of succinic acid is made to act on carbonate of lime (marble) in fine powder ; the temperature should not then exceed from 122° to 140° F. By cooling, the salt separates in crystals which are often several millimetres long ; there is also formed at the same time a little insoluble neutral succinate of lime, although there be sufficient acid to convert all the lime into acid-succinate, and so much the more of it is formed as the temperature of the liquor is higher. It is ordinarily easy to separate these two salts by mechanical means.

SUCCINATES OF LEAD.

Oxide of lead and succinic acid combine in several proportions, the formula of the neutral succinate is $C^4 H^2 O^3$, PbO. Several basic succinates, differing in their proportion of water, may be obtained, namely—$C^8 H^5 O^7$, 3 PbO, $C^8 H^4 O^6$ 3 PbO, &c. ; perbasic succinate of lead, $C^8 H^3 O^5 + 5$ PbO, is obtained when we add subacetate of lead, and at the same time a little ammonia to a solution of succinate of ammonia, a white salt insoluble in water is then formed.

SUCCINATE OF SILVER,
$C^4 H^2 O^3$, Ag O.

Free succinic acid, and its neutral combinations with the alkalies, precipitate the nitrate of silver; a white insoluble salt is formed, which, dried at the ordinary temperature, does not lose water at 392° F., but at this high temperature its color is changed.

SUCCINATE OF OXIDE OF ETHULE,
$C^4 H^2 O^3$, $C^4 H^5 O$.

The most expeditious process for obtaining large quantities of succinic ether (impure indeed) consists in mixing succinic acid with alcohol of about 95 per cent., in heating the mixture to ebullition, and then in passing hydrochloric acid gas into it until we ascertain, by treating a small portion of it with water, that sufficient succinic ether is formed. In order to purify the impure ether, Professor Fehling gently heats it in a sand-bath in order to drive off the small quantities of chloride of ethule, then he adds to the liquor a little carbonate of soda and water, washes it 6 or 8 times with pure water, heats it, dries it over chloride of calcium, and rectifies it ; he sets aside the portion of the product which distils at 214°. With respect to the rectification of succinic ether over oxide of lead, employed by M. D'Arcet, it always partially decomposes this ether. The pure ether has the properties indicated by M. D'Arcet. This chemist found the specific gravity of the vapor of this ether =6·25 ; Fehling makes it 6·30. According to calculation it is =6·05.

The action of potassium or sodium on succinic ether gives rise to a slightly yellowish white body, fusible at 270° F., and completely subliming at 403° F. The most simple expression of its composition has been found $=C^6 H^4 O^3$. This combination is analogous in its properties to the combinations of oxide of ethule ; insoluble or sparingly insoluble in water it readily dissolves in alcohol, especially with the aid of heat. Cold ether dissolves it in all proportions. Professor Fehling proposes hereafter to resume the study of this product.

SUCCINATE OF OXIDE OF METHULE.

The author obtained this combination by a process analogous to that of the preparation of the combination of ethule, by causing hydrochloric acid gas to react on a hot solution of succinic acid in pyroxylic spirit.

It fuses at 68° F.. and solidifies at a little below 60° F. ; it is sparingly soluble in water, and dissolves, on the contrary, in alcohol and ether, it boils at 388° F. The specific gravity of the liquor is, at 68° F., =1·1179. The composition of the combination $=C^4 H^2 O^3 + C^2 H^3 O$.

SUCCINAMIDE,
$C^4 H^2 O^2$, H^2.

M. D'Arcet, who did not know this body, gave this name to another compound. M. Fehling obtained succinamide by the action of liquid ammonia on succinic ether ; by stirring frequently a white deposit is very soon formed, whose quantity increases in the space of a few days. This precipitate was washed with alcohol in order to remove all the succinic ether, then dissolved in boiling water, in which it crystallises in great quantity by cooling under the form of needles, which lose no more water, when they are heated to 212° F. These crystals dissolve in from 8

to 9 parts of water at 212° F., but only in 220° at 59° F. Succinamide is almost insoluble in absolute alcohol; it is more soluble in aqueous alcohol; it is insoluble in ether.

If succinamide be slowly heated towards 390° F., and if it be kept for some time at this temperature, it speedily disengages a great quantity of ammonia; if the temperature be afterwards gradually raised, it finally sublimes into a white mass, and little charcoal remains in the retort. The product of the sublimation is bisuccinamide, which has sometimes a rather acid reaction. It is dissolved and crystallised to obtain it perfectly pure.

Succinamide contains exactly the elements of bisuccinamide and ammonia.

$$2\ (C^4\ H^4\ O^2 N) = C^8\ H^3\ O^4\ NH^2 + NH^3.$$

BISUCCINAMIDE.

The most simple mode of preparation consists in neutralising ammonia in a solution of succinic acid, in evaporating the mass to dryness, and then subliming; ammonia and water are at first disengaged, and bisuccinamide and a small quantity of succinic acid are sublimed; the latter is removed by several crystallisations.

The aqueous solution of bisuccinamide dissolves a great quantity of oxide of lead by means of simple digestion, but still more readily by ebullition. Carbonic acid decomposes this combination, and precipitates a portion, if not the whole, of the oxide of lead, in the state of carbonate.

Baryta appears also to form a similar combination with bisuccinamide; carbonic acid precipitates from it only a portion of the baryta.

II. CONSTITUTION OF SUCCINIC ACID.

According to the accurate investigations of M. D'Arcet, $C^4\ H^3\ O^3$ is admitted as the expression of the composition of one equivalent of anhydrous succinic acid; succinic acid is, therefore, an unibasic acid. Now, it offers this peculiarity, that it is susceptible of being also isolated under the anhydrous form in which it exists in its own compounds; a simple elevation of temperature is alone sufficient to separate from it the basic water; it is not ordinarily the same, as is known, with the other acids. Tartaric acid, indeed, also presents some trace of resemblance; its basic water may, indeed, likewise be eliminated from it by heat; but M. Frémy has shown that there is formed, in this case, two acids entirely different from tartaric acid, which may return to the state of tartaric acid by the absorption of water.

Benzoïc acid, which is as volatile as succinic acid, acts in a different manner; it is impossible, by heating it with anhydrous phosphoric acid, to obtain it in the anhydrous state $= C^{14}\ H^5\ O^3$.

From the whole of the facts which Professor Fehling has observed, and from those previously known, he thinks that he may conclude that the acid of M. D'Arcet, $C^4\ H^2\ O^3$, still contained water ($\frac{1}{2}$ equivalent), and that the anhydrous succinic acid, as it exists in his combinations, is $C^4\ H^2\ O^3 - \frac{1}{2}\ HO$, or, more accurately, $2\ C^4\ H^2\ O^3 - HO = C^8\ H^3\ O^5$, and this formula will then express 1 equivalent of anhydrous acid. He founds his opinion principally on the composition and properties of hyposulpho-succinic acid and its salts, bisuccinamide, basic succinate of lead, and succinate of oxide of ethule. But this hypothetical dry acid is not susceptible of being isolated without decomposition.

The crystallised acid, $C^4\ H^2\ O^3 + HO$, would be, according to this view, $C^8\ H^3\ O^5 + 3\ HO$; this acid would contain, therefore, 3 eqs. of water separable by bases; that is to say, it is a tribasic acid. In certain respects, this acid certainly does not resemble polybasic acids, especially because it has not hitherto been possible to prepare the tribasic succinate of silver $= C^8\ H^3\ O^5 + 3\ Ag.\ O$, any more than the double salts containing potassa and soda; however, it differs in many respects from the unibasic acids.

Now, if the crystallised acid is a tribasic acid, we should expect to have, as with the citric and phosphoric acids &c., 3 series of salts, namely:—

$$\overline{S},\ 3\ MO \qquad \overline{S},\begin{cases} 2\ MO \\ HO \end{cases} S, \qquad \begin{cases} MO \\ 2\ HO \end{cases}$$

(M. here designates a metal.)

Most of the combinations examined belong only to the second series.

If the crystallised acid $\overline{S},\ 3\ HO$, be heated to 284° F., it loses HO; the sublimed acid is formed $= \overline{S}\ 2\ HO$; at a high temperature, it disengages still more water, and there is a formation of anhydrous acid $\overline{S}\ HO$: we have here, therefore, three acids S, 3 HO, $\overline{S}$ 2 HO, 2 HOS HO analogous in their formation and composition with the three phosphoric acids.

These three succinic acids present great differences in their properties, and it may be concluded that the disengagement of water, without decomposing the radical, may, however, effect a change in the constitution of the acid, as is observed in similar circumstances with phosphoric and tartaric acids. Crystallised acid fuses at 356° F., and boils at 465° F.; sublimed acid fuses at 320° F., and boils at 467° F.; the anhydrous acid fuses at 287° F., and boils at 482° F.

It is evident that the acids which contain least water have a lower point of fusion than the crystallised acid. But now, the most important question to be solved was, whether the succinic acids, corresponding to pyro and meta phosphoric acids, may also form peculiar salts which may be to the ordinary succinates what the pyrophosphates are to the phosphates. However, the acids indicated seem to be promptly converted into ordinary succinic acid, by contact with water, in the same way as tartralic and tartrelic acids from tartaric acid, in similar circumstances.

A bibasic salt of lead, $\overline{S}$, 2 Pb O, seems to be separated by heat from ether, which holds in solution oxide of lead; the unibasic acid $\overline{S}$, HO, has been found by Professor Fehling in only one combination, the product of decomposition of succinic ether by potassium $=\overline{S}AeO$.

Bisuccinamide should also be considered as a product of the decomposition of this *latter* acid,

$C^8 H^3 O^5$ and $NH^3 = C^8 H^3 O^4$, NH^2—HO.

The succinamide extracted from succinic ether is the only combination whose composition is more simple if we admit anhydrous succinic acid $= C^4 H^2 O^3$; this combination is then $= C^4 H^2 O^2 + 2N H^2$; if we double this formula, $C^8 H^8 O^4 N^2$, we may consider this body as $C^8 H^3 O^4 NH^2 + NH^3$; that is to say, as a combination of bisuccinamide + ammonia, and this formula accurately expresses the mode of decomposition of this amide at an elevated temperature. The mode in which succinamide acts with chloride of platinum also comes in support of this opinion: if we add chloride of platinum to a boiling solution of succinamide, there is formed by cooling, or by evaporation at a gentle heat, yellow octahydrous of a combination presenting the greatest resemblance to the ammoniacal hydrochlorate of platinum, of which it has also the composition: this salt does not contain it; it contains 40 per cent. of platinum and 2·0 of hydrogen. Bisuccinamide, treated by chloride of platinum in the same manner as succinamide, gives a clear solution, which remains so, even when evaporated to the consistence of a syrup, The residue forms with water a clear solution; but the latter precipitates, by the addition of alcohol, a very slight trace of ammoniaco-hydrochlorate of platinum. Its quantity is extremely small, compared with that furnished by succinamide. 1 gramme of succinamide gave exactly 2 grammes of ammoniaco-hydrochlorate of platinum; this result is in accordance with the opinion which admits 1 equivalent of ammonia $= NH^3$ in $C^8 H^8 O^4 N^2$.

ON THE VOLATILE ACIDS OF BUTTER.*

BY J. U. LERCH.

M. Chevreul's process of preparing the volatile acids of butter consists, as every one knows, in decomposing the soap of butter by tartaric acid, in kneading the fat acids separated with water, until the water which runs off has no longer any acid reaction. This acid water contains in solution butyric, caproïc, and capric acids: it is saturated by baryta-water, and evaporated to dryness: the three corresponding barytic salts are separated from each other by means of their difference of solubility in water. M. Lerch finds, especially, two inconveniences in this process. In the first place, only a small quantity of volatile fat acid is obtained, partly because they are sparingly soluble, and because, although kneaded with water, they are not very-thoroughly penetrated by that liquid, a condition necessary for the complete solution of the soluble acids; and, in the second place, it is not done out of access of the air, and, consequently, the possibility of an alteration of this fluid is not avoided; the powerful odor of the volatile acids of butter may already cause it to be presumed. The author pursued the following pocess:—He completely saponifies fresh butter by potassa in an alembic. This soap is decomposed in the retort by sulphuric acid, then the head is luted, and the aqueous liquid distilled to one-fourth. More water is then added, and it is again submitted to distillation, and continues thus until the water extracted by distillation has no longer any acid reaction. In this manner, the volatile fat acids pass into the receiver like essential oils. We likewise operate out of the action of the air. From about a pound of butter, 4—5 measures of a milky liquid obtained, on which arise drops of oil, as well as a solid or soft fat substance. The aqueous product of the distillation is immediately saturated in the same manner by baryta-water, and it is kept well corked till the end of the distillation. When the latter is concluded, the retort is cleaned, and, after having put on the head, the liquors saturated with baryta-water are evaporated until reduced to one-twentieth, and, finally, the concentrated solution is evaporated to dryness while still warm, in a retort. The mass of barytic thus obtained is formed of two parts, one very soluble, the other sparingly soluble. The very soluble portion is formed, according to circumstances, of two barytic salts, butyrate and

* *Annalen der Chemie und Pharmacie.*

caproate, or only of the barytic salt of a new acid, which the author calls *vaccinic acid*; it then contains little or no butyric and caproïc acids.

The sparingly soluble portion is formed of barytic salts of two different acids, which M. Chevreul has described together under the denomination of *caproate of baryta*. The sparingly soluble salts of baryta form about the twentieth of the very soluble salts, and the whole of the salts of baryta nearly of the saponified butter. In order to separate these salts from one another, this mass is boiled with about 5 or 6 parts of water. The very soluble portion is dissolved; that which is sparingly soluble remains. The solution of the very soluble salts is made to crystallise. If we obtain at the first crystallisation crystal presenting the appearance of benzoate of lime which do not efflorescc, it is caproate of baryta, and we have also in the solution the second salt, the butyrate of baryta. But there are formed groups of small crystals the size of a nut, which rapidly effloresce, and which have the appearance of certain groups of natural carbonate of lime; it is vaccinate of baryta; then neither butyrate nor caproate of baryta must be sought for.

The circumstances in which butter contains vaccinic acid, or butyric and caproïc acids, are unknown to the author. The butter of the summer of 1842, which was remarkable for its great dryness, as well as that of the following winter, presented to him, in several experiments, no other very soluble barytic salt than the vaccinate; on the contrary, the butter in the summer of 1843, did not contain vaccinic acid, but contained the other two acids, butyric and caproïc.

SEPARATION OF THE VERY SOLUBLE BARYTIC SALTS.

To separate the butyric and caproïc acids, the mixture of the very soluble barytic salts is dissolved in water and the liquor is evaporated, in order that it may crystallise. The first crystallisations give long needles of a silky lustre, grouped under the form of tufts; if we seize the proper degree of concentration of the liquor, almost all the caproates crystallise. All the solution is formed into a pap of fine needles, from which the fluid is carefully pressed, and which is purified by several crystallisations. The remainder of the liquor is then abandoned to spontaneous crystallisation by exposure in preference to the sun. At first, new crystals of caproate of baryta are obtained, then the form changes; laminar crystals of a pearly lustre are seen to appear; the ulterior crystallisations are all almost pure butyrate of baryta, whose purification is completed by several crystallisations.

BUTYRIC ACID.

The salts of this acid have been accurately described by M. Chevreul; M. Lerch contents himself, in his memoir, with detailing, with respect to them, the facts concerning which he disagrees with M. Chevreul, or concerning which the latter chemist has made no investigations.

The butyrate of baryta presents two different crystallisations: one is formed, as M. Chevreul described it, of bracteæ, and of flexible flattened prisms; the other of hard, granular crusts: it is, however, possible, by means of several crystallisations, to change also this latter form into the former. The butyrate does not contain water of crystallisation. If the purity of the salt is complete, it is almost inodorous, unalterable in the air, in a sand-bath, and infusible. MM. Pelouze and Gélis state that this contains water of crystallisation, and that it fuses at 21° F. M. Lerch concludes that these chemists examined a salt of a different constitution. According to his analyses, the formula of butyrate of baryta is $C^8\ H^7\ O^3$* + Ba O, and its atomic weight 1951·07.

BUTYRATE OF SILVER.

This salt forms a coagulated precipitate when nitrate of silver is decomposed by concentrated solutions of butyrate of baryta; if the solutions are very dilute, turbidness only is produced; the liquor then gives rise, by spontaneous evaporation, to dentritic crystals of butyrate of silver. If, in the precipitation of this salt, a reduction is operated, it arises from the presence of a small quantity of vaccinic acid. Its formula is $C^8\ H^7\ O^3$, Ag O, and its atomic weight 2445·8.

BUTYRATE OF OXIDE OF ETHULE.

It is easily obtained by mixing the salt of baryta with alcohol and sulphuric acid, and boiling the mixture. The ether separates on the surface immediately after it has been heated. It is removed, washed with water, dishydrated by chloride of calcium and rectified. The product of the distillation is collected only when the boiling point reaches 230° F. Butyric ether is a very mobile limpid liquid; it has a very agreeable odor of fruit, similar to that of pippins; its taste is sweet, with a slightly bitter after-taste: it boils at 230° F.; its formula is $C^{12}\ H^{12}\ O^4$.

* This result agrees with that of MM. Pelouze and Gélis, but it differs from that which has been obtained in the laboratory of M. Mulder, and which gives, conformably to the investigation of M. Bromeis, $C^8\ H^6\ O^3$ + Aq, as the formula of butyric acid.

CAPROÏC ACID.

Caproate of Baryta.—It crystallises in prismatic needles of the length of 0m 027 to 0m 041, of a silky lustre, grouped in the form of tufts. It does not contain water of crystallisation, and is not altered in the air. Its composition corresponds to the formula C^{12} H^{12} O^2 + Ba O. Its atomic weight is 2304.

Caproate of silver.—The precipitation of a solution of caproate of baryta by nitrate of silver, gives rise to a coagulated white precipitate, which is not reduced. It is much less soluble in water than butyrate of silver, and does not crystallise. Its formula is C^{12} H^{11} O^3 + Ag O.

Caproate of oxide of ethule.—It is obtained like butyric ether; it is formed and separated more easily and more promptly than the latter, after the salt of baryta has been heated with alcohol and sulphuric acid. Is is collected in the rectification only when the boiling point reaches 248° F. It is limpid; it has a taste and an odour analagous to those of butyric acid, but rather stronger. The odor, however, is not so fine and has a greater resemblance to that of butter. The boiling point is 248° F. It is composed of C^{16} H^{16} O^4.

SPARINGLY SOLUBLE SALTS OF BARYTA.

The mass of these latter is likewise formed of salts of two different fat acids. The author calls *caprylic acid* that which furnishes the most soluble salt of baryta; he retains for the other the denomination of capric acid given by M. Chevreul. Their separation does not present any particular difficulties.

The residue of the solution of the caproate and butyrate of baryta is dissolved in the quantity of boiling water necessary for effecting its complete solution, and the liquor is filtered while still warm. During cooling, this latter is filled with fine scales of a greasy lustre of caprate of baryta, which are deposited under the form of a crystalline precipitate.

The mother-liquors are decanted and evaporated until reduced to about one-fourth; by this means, a fresh quantity of crystals of caprate of baryta is obtained. They are all purified by several crystallisations. The mother-liquors of this salt contain caprylate of baryta in solution. The best mode of evaporation consists in exposing them to the sun; there are then formed grains of the size of poppy-seed and small pappy groups of caprylate of baryta.

Such is the best means of separating the very soluble and the sparingly soluble salts of baryta; but it is not possible to isolate them completely.

CAPRYLIC ACID.

Caprylate of baryta.—It crystallises, by evaporation in warm solutions, in fine scales with a greasy lustre, and by spontaneous evaporation in the air, in white grains, of the size of poppy-seeds, resembling lime. It is sparingly soluble in water, unalterable by desiccation in the air, as well as at the temperature of 212° F. It does not contain water of crystallisation. The solutions are not decomposed by long exposure to the air. It is formed of C^{16} H^{15} O^3 + Ba O, and its atomic weight is = 2657·7.

CAPRYLATE OF SILVER.

It forms a white precipitate, almost insoluble in water, by the mixture of a solution of barytic salt with nitrate of silver.

CAPRIC ACID.

Caprate of baryta.—This salt crystallises by cooling from hot solutions in needles or in fine small scales, grouped under the form of dendrites, a property which distinguishes it from the caprylate. It is very sparingly soluble in water. Almost all the salt precipitates from a solution carried to the heat of ebullition. It is not altered by desiccation in the air or at the temperature of 212° F. It does not contain water of crystallisation. The aqueous solution is not decomposed by long exposure to the air; its formula is C^{20} H^{19} O^3 + Ba O, and its atomic weight 3011.

VACCINIC ACID.

We will here call to mind that, when the very soluble barytic salts of the volatile acids of butter are dissolved in water and crystallised, or else when crystals of caproate of baryta are first obtained, and butyrate of baryta remains in solution, or when groups are formed, of the size of a nut of small prismatic crystals; that, in this latter case, it is useless to seek for caproïc and butyric acids, but that they contain a new acid, *vaccinic acid.*

VACCINATE OF BARYTA.

Its crystals, whose form has just been described, contain water of crystallisation, effloresce very readily in air, and become quite like chalk, and have a very distinct odor of butter, whilst the pure caproate and butyrate do not effloresce at all, and are almost inodorous. Its solubility in water is nearly equal to that of the butyrate. The saturated solution is as thick as oil. If vaccinate of baryta be redissolved in water, and if the liquor be evaporated in a retort, it crystallises without alteration. If the crystals be exposed for a long time to the air, they finally almost completely lose their odor. If they they are then redissolved, they do not crystallise; but

we obtain in their place crystallisations of caproate and butyrate of baryta. A long exposure to the air, or long boiling in open capsules of a solution of this salt, produces the same result.

There is then neither a separation of baryta, nor a disengagement of acid vapors: the neutrality remains the same.

Vaccinic acid, therefore, saturates precisely as much baryta as the two acids to which it gives rise. The relative quantity of caproate and butyrate of baryta formed is in the ratio of the atomic weights of these two salts. If vaccinate of baryta be decomposed by sulphuric acid in the air, if the acid separated be distilled, if it be saturated by baryta, and if the solution be crystallised, only caproate and butyrate of baryta are obtained. If a solution of vaccinate of baryta be mixed with a solution of silver, a white coagulated precipitate is formed, which is soon reduced, and which smells strongly of butyric acid.

It results from these investigations that vaccinic acid is easily decomposed under the influence of oxygenising substances, air and oxide of silver, into two acids—the caproïc and butyric; as neither any carbonaceous substance nor baryta is separated. Vaccinic acid must contain the whole of the atoms of carbon of the caproïc and butyric acids.

It should saturate quite as much baryta as caproïc and butyric acids combined; only it will contain less oxygen than these two latter, supposing that there is neither diminution nor augmentation of water. However, the author is not yet quite certain of the composition of vaccinate of baryta. The formula $C^{20}\,H^{18}\,O^5 + 2\,Ba\,O$ to which his investigations have led him, but which he does not give as positive, would very well explain its decomposition into butyrate and caproate of baryta; for,

$$C^{20}\,H^{18}\,O^5\,2\,Ba\,O + O = \begin{cases} C^8\,H^7\,O^3 + \\ C^{12}\,H^{11}\,O^3\,Ba\,O. \end{cases}$$

If we compare the four volatile acids of butter, which we have just been studying, we find a striking relation between their formula; they contain, indeed, like the other fatty acids, multiples of C H with 4 atoms of oxygen.

8 atoms of C H give butyric acid, 12 atoms caproïc acid, 16 atoms caprylic acid, and 20 atoms capric acid.

Butyric acid .. $= C^8\,H^8\,O^4 = 8\,C\,H + O^4$
Caproïc..... $= C^{12}\,H^{12}\,O^4 = 12\,C\,H + O^4$
Caprylic ..... $= C^{16}\,H^{16}\,O^4 = 16\,C\,H + O^4$
Capric..... $= C^{20}\,H^{20}\,O^4 = 20\,C\,H + O^4$

ON A NEW MODE OF ANALYSING BLOOD, AND ON THE CHEMICAL CONSTITUTION OF THE BLOOD GLOBULES.*

BY M. L. FIGUIER.

The principle of this new mode of analysis is based on a fact observed some years ago by Berzelius. This chemist found that if we add to blood, deprived of fibrin by beating up a solution of a neutral salt, as sulphate of soda, sea-salt, or a solution of sugar, the greater part of the globules may be retained on the filter; whilst, in the ordinary conditions, blood deprived of fibrin thrown on a filter, passes through the paper with all its globules. I have been enabled, after several ineffectual attempts, to regulate this curious fact in such a manner as to render it applicable to the accurate analysis of the blood. Thus I found that, by employing a solution of sulphate of soda, marking from 16° to 18° Baumé, and taking two volumes of the saline solution for one volume of blood, all the globules remain on the surface of the filter. If the liquid which has passed through the paper be examined with the microscope, it will be perceived that scarcely 5 or 6 globules have escaped the action of the filter, whilst the layer left on the paper fills the range of the instrument with pressed globules, leaving but very small space between each.

According to this, the analysis is reduced to these few very simple operations.

The operation of beating gives the weight of the fibrin. The weight of the globules is obtained by collecting the latter on a filter, by means of the saline solution; that of the albumen, by coagulating, by heat, the filtered liquid.

Finally, the proportion of water is determined by the evaporation of a small quantity of liquid from a known weight.

It is easy to comprehend all the advantages of a method which enables us to isolate and directly estimate all the elements of the blood: its advantages will, moreover, be more apparent, if it be compared with the process now universally followed, and which we owe to M. Dumas. This process, which we cannot detail here, requires, as is known, long and very numerous operations. Such as it is, however, it was sufficient for MM. Andral and Gavarret to enrich science with results which are known. Nor will I stop to discuss the real value of the slight chances of errors which this method may present. Those who have taken on themselves this task, have doubtless forgotten that the analysis of the complex matters of the economy

* *Comptes Rendus*, No. 2, July 2, 1844.

cannot aspire to the rigid accuracy of our mineral analyses.

However, with regard to the comparative value of these two methods of analysis, it is sufficient, I think, to show the superiority of that whose adoption I propose, to say that, by its employment, all the elements of the blood being isolated and determined by direct weighing, all chance of error seems to be avoided. I will only add that it presents, also, two peculiar advantages. The first is that it requires only a very short time, and simple operations; the second, and the most remarkable, is, that it allows of a very small quantity of blood being operated on. Thus it will be perceived that 80 or 90 grammes of blood are the most quantity for determining the proportion of the globules, albumen and water. Now, as the diseases in which the chemical study of the blood presents most interest are precisely those in which the patients are least frequently bled (phthisis, scurvy, chlorosis, cancerous affections, and organic derangements), it will be perceived that this circumstance presents a very high degree of interest.

A small quantity of blood required by analysis will therefore in future enable us to submit it to an examination of another kind, and to ascertain whether the chemical alterations which are produced in it under the influence of diseases, would not be remedied by the appearance of new substances, or by a modification of nature in its ordinary element.

It is known that, by the present process, this investigation is not possible, since the whole of the blood drawn is consumed by analysis.

The following are a few details necessary for putting the process in practice:

The blood furnished by bleeding is beaten up immediately after leaving the vein, as in M. Dumas' process. The fibrin is separated and adheres to the small twigs of willow. The liquid is strained through a fine cloth, in order to separate the portion of fibrin, which does not adhere to the twig. This fibrin, washed in a current of water, afterwards in a water-bath, is weighed after having been treated, if it be desired, by ether, in order to remove a little fatty matter.

By taking the weight of the total blood of the bleeding, which gave this quantity of fibrin, we add the proportion of fibrin to the other elements of the blood.

Afterwards only 80 or 90 grammes of this blood, deprived of fibrin, are taken; it is diluted with twice its volume of a solution of sulphate of soda, marking from 16 to 18 degrees Baumé, and thrown on a filter previously weighed and moistened with a saline solution. With these precautions, serum filters very rapidly, and with a yellowish color.

It is understood, that in order to remove from the globules left on the filter, the solution of sulphate of soda with which they are impregnated, the filter cannot be simply washed, for that would partially dissolve the globules, and the liquor would pass through as red as blood; but a peculiar property of the globules fortunately enables us to overcome this difficulty. When they are heated to 194° F., the globules completely coagulate, and the whole mass becomes concrete, without yielding to water any organic matter. It is then necessary only to plunge the filter into a capsule containing boiling water. The sulphate of soda is dissolved, and water removes nothing from the globules, for the liquor is almost colorless, and does not contain any organic matter appreciable by tannin or corrosive sublimate.

In order to separate the albumen from the filtered serum, it is sufficient to boil it in a capsule. The albumen coagulates; it is collected in a small bag of fine cloth, washed, and weighed after having been dried in a hot-water bath.

Finally, in order to determine the quantity of water contained in the blood, from 20 to 25 grammes of it are taken, which are evaporated to dryness in a sand-bath. The weight of the residue indicates the proportion of water and solid elements.

The soluble salts of the serum are represented by the difference of the weight of blood employed, and the sum of the albumen, water, fibrin and globules determined directly.

The foregoing observations have been made on account of some investigations concerning the chemical constitution of the blood globules, of which I will say a word in concluding:—

It is known that opinions are divided concerning the chemical nature of the blood globules. Several chemists adopt the opinion of Berzelius, who regards the globules as a chemically homogenous matter, and representing the hœmatosin or coloring matter of the blood.

Microscopical examination has led other observers to regard the globules of the blood of the mammifera, or other vertebrate animals, as formed of an external ring and central nucleus, which differs in its composition from the coloring matter itself.

I think that the existence of three quite distinct matters may be demonstrated in the blood:—1st, the coloring matter or hœmatosin; 2nd, albumen; 3rd, a small quantity of fibrin; belonging, doubtless, to the

central nucleus admitted by some physiologists.

1. If the globules are separated on a filter by means of sulphate of soda, and treated by ammoniacal alcohol, the coloring matter very readily dissolves, leaving a brown coagulum. This is an extremely easy process for obtaining, without any kind of alteration, the coloring matter of the blood. The evaporation of the alcohol furnishes a mass of a fine bistre red, presenting all the characters which M. Lecanu noticed in hœmatosin.

2. If the globules isolated on the filter be dissolved in water, a blood-red liquor is obtained, which, filtered, precipitates abundantly by the acids and by alcohol, and coagulates by ebullition. (Berzelius has already indicated the coagulation of the globules by the action of heat.) As hœmatosin in its solution in alcohol does not coagulate by heat, and is not precipitated by an excess of nitric acid, it is probable that in the globule of the blood there exist both albumen and coloring-matter.

3. The globules of the blood, isolated and dissolved in water, deposit, after 12 hours, a red matter, which, washed by decantation, present all the characters of the blood.

The experiment occupies a longer time with the globules of the human blood, on account of the extreme smallness of its globules; but the fact is promptly proved also with the blood of the frog. Müller has, moreover, shown that blood of the frog, deprived of fibrin, and simply diluted with water, precipitates similar nuclei, which turn white by washing.

It is therefore probable that the globules of the blood contain at once a small quantity of fibrin, albumen, and coloring-matter of the blood.

This constitution has already been suspected by some microscopic writers.

In conclusion, I will observe, that the employment of sulphate of soda or other saline solutions for isolating or retaining on a filter the globular matters in suspension in organic liquids, is susceptible of acquiring, I think, an extension worthy of interest and of successful application, if not to quantitative analysis, which is not always necessary, at least to the complex matters which constitute animal liquids, such as milk, mucus, chyle, and lymph. Thus, milk, treated like blood, by sulphate of soda, leaves on the filter all the fatty matter, and the liquid, after a certain time, passes, limpid and charged with caseïn, susceptible of being separated by the action of acetic acid to ebullition.

REPORT ON A MEMOIR BY M. PAUL THENARD, ON THE COMBINATIONS OF PHOSPHORUS WITH HYDROGEN.*

BY A COMMITTEE COMPOSED OF MM. GAY-LUSSAC, REGNAULT, AND PELOUZE (REPORTER).

Before making a report to the Academy on a memoir presented to it by M. Thénard, we think it useful briefly to mention the principal works of which the phosphurets of hydrogen have been the subject. In heating phosphorus with a solution of caustic potassa, Gengembre, a French chemist, discovered, in 1783, a gas composed of phosphorus and hydrogen, possessed of the curious property of inflaming spontaneously in contact with the air.

It was very soon remarked that this gas, preserved over water or mercury, gradually lost its inflammability, and deposited a yellow matter, which was regarded as phosphorus until 1835, when M. Leverrier demonstrated that it consists of a true solid phosphuret of hydrogen.

Some years after Gengembre's discovery, Sir H. Davy observed that phosphorous acid, submitted to the action of heat, gave rise to a phosphuretted hydrogen gas, deprived of the property of spontaneous inflammability, and he considered this new gas as different from the other.

The composition of these phosphurets of hydrogen remained unknown. We were acquainted only with the nature of their constituent principles. We knew not the relations which they presented either with each other or with the gas which loses, a certain time after preparation, the property of burning in contact with cold air.

Several chemists undertook to fill up this gap. Thomson and Vanquelin sought to determine how much hydrogen a volume of each of these phosphuretted gases contains. Time did not confirm the results of their analyses. The first accurate experiment concerning the composition of the phosphurets of hydrogen are due to MM. Gay-Lussac and Thénard. They found that the spontaneously inflammable gas contains 1½ times its volume of hydrogen.

Houton-Labillardiére, and afterwards Dumas, verified this proportion in the two phosphuretted gases. It was admitted, although without sufficient proof, that the spontaneously inflammable gas contained more phosphorus than that which is deprived of this property, and they were, consequently,

* *Comptes Rendus*, No. 21, May 20, 1844.

designated under the names of *per-phosphuretted hydrogen gas* and *proto-phosphuretted hydrogen gas*. It was supposed that the first owed its inflammability to the more considerable proportion of phosphorus which it contains, and it was considered that the loss of this inflammability was explained by the loss of phosphorus. Dumas, who published, in 1826, a work on these gases, assigned to them the formulæ Ph H^2 and Ph H^3; the first of which represents the composition of spontaneously inflammable phosphuretted hydrogen gas, and the latter of uninflammable gas.

These formulæ were generally adopted, and they seemed, indeed, perfectly established when, in 1827, H. Rose expressed doubts concerning their accuracy, and, contrary to the opinion of Dumas, he admitted that the gas which inflames in the air at the ordinary temperature, contains less phosphorus than that which is deprived of this property, and he assigned to it the formula Ph H^2, which Dumas had given to Davy's gas.

He admitted, besides, that the gas which had lost over water its inflammability, was a mixture of two other gases.

However, afterwards recurring to this very delicate subject (in 1832) of the phosphurets of hydrogen, Rose corrected an important point of his previous work, and he definitely concluded, from his new investigations, that the phosphuretted hydrogen gases, although, besides, so different in their properties, present exactly the same composition, and are, consequently, only isomeric modifications of each other.

In the hope of discovering the cause of the differences which the phosphurets of hydrogen present with respect to their combustibility, Graham submitted these gases to a new examination: the results at which this skilful chemist arrived did not answer his expectation, with respect to the explanation which he sought; but he nevertheless found some very important facts, which prove that imponderable traces of matters may communicate inflammability to a gas which does not possess it, or remove it from one which does.

Finally, M. Leverrier, who published, in 1835 (*Annales de Chimie et de Physique*, t. ix.), a remarkable work on the phosphurets of hydrogen, was led to inductions which the experiments of M. Thénard have converted into certain conclusions.

Now that we have touched on the principal points of the history of the phosphurets of hydrogen, it will be more easy to appreciate the importance of M. Thénard's work.

According to this chemist, there exist three combinations of phosphorus with hydrogen.

The first is solid, and of a yellow color. It is the substance which the spontaneously inflammable gas deposits, and which was taken, before M. Leverrier's time, for phosphorus. M. Leverrier, who had obtained it in very small quantity, and doubtless impure, considered it to be formed of equal equivalents of phosphorus and hydrogen. M. Thénard, who prepares it easily, and in a perfect state of purity, has arrived at a different result. He assigns to it the formula Ph^2 H.

This phosphuret is formed in many circumstances, but, of its different modes of preparation, the best consists in receiving the spontaneously inflammable gas into liquid hydrochloric acid. It deposits in it the solid phosphuret, which is washed with cold water, and which is rapidly dried in the pneumatic machine.

The second phosphuret of hydrogen is the non-spontaneously inflammable gas. It is obtained pure by projecting phosphuret of calcium into almost fuming nitric acid, by means of a vertical tube plunging into the acid liquid.

At the same time as this gas a considerable quantity of solid phosphuret is formed, which remains in suspension in the hydrochloric acid, without undergoing alteration in it.

When, instead of acid, water is employed, the gas, as is known, is always spontaneously inflammable, but it is never pure; it contains free hydrogen, whose proportion increases with the duration of the experiment, and, however, the total quantity of phosphuretted hydrogen gas obtained by the same weight of phosphorus, is greater with water than with hydrochloric acid. These differences are owing, on one hand, to the formation of a hypophosphite, and, on the other hand, to the solid phosphuretted hydrogen first produced being decomposed, whilst with hydrochloric acid hypophosphorous acid is not formed, or, at least, only traces of it; and, on the contrary, to the production of much solid phosphuretted hydrogen, which remains unalterable in the acid itself.

Several bodies, such as the protochloride of phosphorus, hydrochloric and hydrobromic acids, &c., deprive the gas obtained with water and phosphuret of calcium of its spontaneous inflammability; it also gradually loses it, especially in the light, or by the sole contact of the sides of the vessel in which it is kept. In these different circumstances it deposits solid phosphuretted hydrogen, and is changed into non-spontaneously inflammable phosphuretted hydrogen.

By seeking the explanation of these facts, and by analysing them with skill and perseverance, M. Paul Thénard has discovered a

new combination of phosphorus and hydrogen, whose existence will throw great light on the causes of the inflammability of phosphuretted hydrogen gas.

He found a simple and easy means of saturating lime with phosphorus; he perceived that, by gradually projecting the compound which results, into very weak hydrochloric acid, a heavy matter was sometimes deposited, which, on coming in contact with the air, immediately takes fire; and he considers that this matter, in being reduced into vapor, in phosphuretted hydrogen gas, might indeed be the cause of the easy inflammability which this gas sometimes presents.

Guided by his observations, and by the profound examinations to which he had submitted the phosphuret of hydrogen, M. Thénard passed the gas obtained with water and phosphuret of calcium into tubes, and he immediately collected a liquid phosphuret of hydrogen, which had escaped all the chemists who have been occupied with the same question, whose discovery constitutes the chief point of his work. This phosphuret is liquid below 10° C.; its tension is considerable; it is colorless, and perfectly transparent. It inflames with extreme energy in contact with the air, and it burns with a white flame, endowed with a most vivid lustre.

Exposed to the solar light, it is rapidly changed into solid yellow phosphuret. This decomposition, which takes place even in diffused light, renders experiments on liquid phosphuretted hydrogen very dangerous. However, by means of certain precautions, M. Thénard has been able to determine the composition of this new substance, by turning to account its very mode of decomposition. He ascertained that, for a quantity of solid phosphuret, represented by $Ph^2 H$, it gives a volume of phosphuretted gas entirely absorbable by sulphate of copper, whose weight is equivalent to 3 ($Ph H^3$). He concludes from this that the formula of the new phosphuret is

$$\frac{Ph^2 H + 3\ (Ph H^3)}{5} = Ph H^2$$

The tendency of this compound to dedouble itself, as we have just said, into two other phosphurets of hydrogen, greatly increases when it is put in contact with hydrochloric and hydrobromic acids, chloride of phosphorus, and a host of other bodies, of very different nature, especially when the latter are in a state of very fine division. In this respect it presents some analogy with oxygenated water and polyphosphuret of hydrogen.

The facts which we have just noticed are of great interest; they singularly elucidate the question of the phosphurets of hydrogen, a difficult question which has long been agitated, and hitherto very obscure. They permit a simple, and in some respects, a natural explanation of the phenomena relative to the greater or less inflammability of the phosphurets of hydrogen.

This explanation is found complete in the existence of the liquid $Ph H^2$, in its excessive combustibility and in its very instability.

Endowed at the ordinary temperature with an excessive affinity for oxygen, which decomposes it with a considerable proportion of heat, it is not surprising that it determines the inflammability of gases formed of combustible elements, such as phosphuretted hydrogen, cyanogen, hydrogen, olefiant gases, &c. It is, in some measure, a combustible which a spark inflames, and which continues so long as the flame finds aliment.

The presence of this liquid phosphuret of hydrogen in spontaneously inflammable phosphuretted hydrogen cannot be doubted, since a simple abatement of temperature is sufficient to separate it from it. Hence, the great combustibility of this gas has in it nothing extraordinary; it is due to this liquid phosphuret, which communicates it indistinctively to all combustible gases.

If spontaneously inflammable phosphuretted gas very soon ceases to possess this property, it is because the liquid phosphuret which it first contained is decomposed. This decomposition, which takes place in the liquid even in the state of purity and of isolation, will be more or less accelerated by the contact of different bodies; whence the explanation of the principle facts observed by Graham concerning the faculty, which a great number of different substances possess, of removing from phosphuretted hydrogen its great combustibility.

The identity of composition noticed by Rose in the spontaneously and non-spontaneously inflammable phosphurets of hydrogen, has in it nothing surprising, since a trace of liquid phosphuretted hydrogen is sufficient for provoking the inflammability of the last of these gases. How would centissimal analyses make known in a certain manner the presence of even a very considerable quantity of liquid phosphuretted in a gas formed of the same elements and in proportions, moreover, so similar?

In support of the hypothesis which consists in considering as isomeric, and as susceptible of being converted into one another, the spontaneously and non-spontaneously inflammable gases, H. Rose particularly noticed the property which they possess of being united to certain metallic chlorides, and to form with these similar identical compounds; so that, for example, when it has been decomposed by water, the latter sepa-

rates from it a gas which does not inflame, whilst with liquid ammonia it inflames, on the contrary, constantly.

M. Thénard has repeated the experiments of Rose; he has extended them, and found their explanation, which is very simple:—

Pure phosphuretted hydrogen gas, well deprived of liquid phosphuret, is not inflammable at the ordinary temperature, but it is sufficient slightly to elevate the temperature in order to render its combustion very easy; at 212° F., it inflames. Every time, therefore, that in consequence of some chemical action, these gases will be employed at the temperature which we have now indicated, if in contact with the air it will inflame. It is precisely this that happens when the combinations of phosphuretted hydrogen with the chlorides of titanium and tin are decomposed by liquid ammonia; the mixture is heated, and the gas which escapes becomes, by that alone, inflammable. This is proved by the fact that, if it be cooled for an instant only, in operating its decomposition over mercury, and afterwards pouring it into the atmosphere, it ceases to be spontaneously inflammable.

The gas separated by water from the above combinations does not inflame in the air, according to H. Rose. This is correct, provided that we operate in such a manner that the gas, at the moment it is disengaged, cannot attain the temperature which determines its combustion. This condition is fulfilled by putting the compound into a considerable quantity of water; but if we be placed in contrary circumstances—if we put much hydrophosphuretted chloride into a small quantity of water, the mixture is heated, and the gas disengaged burns briskly.

It is evident that these are the effects of temperature.

We might multiply the example of interesting reactions, which seemed inexplicable before the appearance of M. Thénard's work; but what we have said will suffice, doubtless, for showing the tendency of this work.

Chemists will know how to appreciate the perseverance, spirit of analysis, and sagacity which the author has evinced in a question whose study was at once so difficult and dangerous. All have with pleasure beheld a young man, who bears a name so well known to them, make his *début* in the career of science in so honorable a manner.

We have the honor of requesting of the Academy the insertion of M. Paul Thénard's Memoir in the *Recueil des Sevantes Etrangers*.

The conclusions of the report were adopted.

MEMOIR ON ALTERATIONS EXPERIENCED BY SOME ORGANIC ALKALIS, IN CONTACT WITH, AND UNDER THE INFLUENCE OF, OXYGEN IN THE NASCENT STATE.*

BY M. EUGENE MARCHAND.

When a solution of sulphate of cinchonine, quinine, morphia, narcotine, strychnia, or bracine, is boiled with an excess of peroxide of lead, adding to the liquor, drop by drop, dilute sulphuric acid, until a portion of the filtered liquor is not rendered turbid when tested with either ammonia or caustic potassa, or by the carbonates of potassa or soda, it may be remarked that, from the commencement of the re-action, a brisk effervescence, due to a disengagement of carbonic acid gas is manifested, and that the liquor acquires a deeper and deeper color. By stopping the operation at the moment which I have just noticed, by saturating the free acid which may exist, by means of litharge, then by evaporating this liquor to dryness, redissolving the residue by distilled water, in order to submit the solution to a current of hydrogen, and finally evaporating the liquor to dryness, coloring matters are obtained very distinct from each organic alkali, and each of which we will study separately.

PRODUCTS DERIVED FROM CINCHONINE.

This alkaloïd, when it is placed in the conditions which we have just indicated, is converted into a new substance, for which I have proposed the name of *cinchonetine*. It is a coloring-matter, which is presented under the form of an uncrystallisable amorphous mass, of a very deep violet color in the mass, and of a yellowish red when in a thin layer. It is deliquescent, and possessed of a bitter taste. When incinerated, it enters into fusion, gives off, like cinchonine, white odorous vapors, containing no ammonia; it inflames, burns with a fuliginous flame, and leaves, as a residue, charcoal which is very difficult to incinerate.

Cinchonine dissolves more easily in boiling water than in cold water. Its best solvent is alcohol. Ether has no action on it. Concentrated sulphuric acid very readily dissolves it with a red color, and without appearing to make it undergo any alteration. If this solution be diluted with water, it assumes a yellow tint, and is not turbid.

The aqueous solution of cinchonetine, which is colored red, does not become turbid under the influence of ammonia or potassa,

* *Journal de Chimie Médicale*, July, 1844.

but, by its contact with these reagents, it assumes a purple color, which afterwards passes to fawn yellow, and the acids cannot restore to it its primitive color. The subacetate of lead occasions in this solution (which chlorine instantaneously deprives of color) a violet precipitate, which is deposited in a few moments.

Cinchonetine may, in contact with peroxide of lead, and under the influence of sulphuric acid, be converted, by aid of heat, into new colorless compounds, among which it appears acetic acid may be reckoned.

PRODUCTS DERIVED FROM QUININE.

The result of the action exerted by the nascent oxygen on this organic base, as a complex matter which acts under the influence of heat, in a manner analogous to cinchonetine, and which may be separated into at least two distinct principles, quinetine, and modified quinetine. The first of these bodies is that which remains when the complex coloring matter is treated by water: it is insoluble in this liquid, but it dissolved in alcohol, to which it imparts a violet color. Modified quinetine is, on the contrary, the principle which water dissolves, acquiring a blood-red color.

Modified Quinetine.

It is presented under the form of an amorphous mass, of a red color, of a bitter taste, soluble in water, alcohol and ether. Its aqueous solution, when it is boiled in order to evaporate it to dryness, is decomposed, depositing a black powder, insoluble in alcohol and ether.

Potassa and ammonia decolor the aqueous solution of this substance, which from red passes to a dirty yellow, but without causing it to undergo any modifications, as is the case with cinchonetine, for the original color may always be restored by saturating the alkali with sulphuric acid. Modified quinetine dissolves in concentrated nitric and sulphuric acids, communicating to them its color.

Quinetine.

By the spontaneous evaporation of its alcoholic solution, this substance may be obtained in great part crystallised. It is insoluble in water, but it dissolves very well in alcohol, ether, and water acidulated with sulphuric acid. It communicates to the first two solvents a violet color, and to the last a red color. Although this substance is insoluble in water, its alcoholic solution is not rendered turbid when diluted with this liquid.

Potassa and caustic ammonia act with it in the same manner as with modified quinetine.

The concentrated acids dissolve quinetine, acquiring a red color. It is probable that it then passes to the state of modified quinetine.

By successive solutions and evaporations, quinetine may be rendered soluble in water, and then it appears to present all the characters of modified quinetine.

PRODUCTS DERIVED FROM MORPHIA.

Morphetine is the product of the oxidation of this base, when it is submitted to the above-mentioned influences. It is a brown, amorphous substance, possessed of a feeble, bitter taste; sparingly soluble in alcohol at 90° C., which it colors yellow; very soluble, on the contrary, in distilled water, to which it communicates, at the same time, a yellow color verging on red, and the property of reddening litmus paper. Sulphuric and nitric acids turn to pale yellow the color of this solution, which becomes, on the contrary, deeper under the influence of caustic alkalis. This solution is not rendered turbid nor altered by trisacetate of lead.

Concentrated sulphuric acid only very difficultly dissolves morphetine. Nitric acid, on the contrary, readily dissolves it, acquiring a yellow color.

Morphetine, submitted in its turn to the action of peroxide of lead, until no more effervescence is produced, is converted into a yellow, uncrystallisable, and deliquescent matter, endowed with acid properties.

PRODUCTS DERIVED FROM NARCOTINE.

When this alkaloïd is submitted to the action of oxygenising bodies, and in the conditions which we have described above, a new coloring-matter is obtained, *narcotein*, which is presented under the form of an amorphous, or crystallisable mass, of a brown color, and possessing a very bitter taste. It is very sparingly soluble in ether, but it dissolves very readily on the contrary, in alcohol and in water. It is soluble in concentrated nitric acid, which it colors yellow. It likewise dissolves with great facility in concentrated sulphuric acid, to which it communicates a magnificent red color, from which it passes to yellow when this solution is diluted with water.

The aqueous solution of narcotein is of a yellow color; when ammonia or caustic potassa is added, the color becomes rather brighter, and even passes to yellowish-red. Subacetate of lead does not alter either its color or its transparency.

Narcotein, when submitted to the action of nascent oxygen, until effervescence ceases, is gradually decolored, and is converted into a new body, the opianic acid, formerly ob-

tained by Liebig and Wöhler, in their experiments on the oxidation of narcoteïn.

PRODUCTS DERIVED FROM STRYCHNIA.

The most remarkable product obtained by submitting strychnia to the action of nascent oxygen is a pulverulent mass, of a brownish-yellow color, insoluble, or very sparingly soluble in boiling water, which it colors of a dirty yellow, and to which it communicates a bitter taste, extremely sparingly soluble in alcohol, soluble in ether, soluble also in water acidulated with sulphuric acid, and boiling, from which it is in great part precipitated by cooling.

The best solvent of this substance is caustic potassa; the solution is of a brown color, and, if we employ only as much potassa as is strictly necessary for operating its solution, the liquor is without action on syrup of violets. When sulphuric acid is added to the solution, so as to communicate to it an acid reaction, it becomes turbid, and deposits a flocculent and yellowish precipitate. The perfectly-neutral alkaline solution has no action on the solution of iron and copper; but it precipitates the solutions of lead and silver. This substance deserves to fix the attention of chemists. The remarkable manner in which it acts with caustic potassa, which it seems to saturate completely, will, perhaps, cause it to be regarded as a *new acid*.

PRODUCTS DERIVED FROM BRUCIA.

The coloring matters which result from the action of oxygen on this alkaloïd are two in number. The first is soluble in boiling alcohol at 90° C., which it colors of a yellowish red. We shall study it in A. The second, which will be studied in B, is insoluble in alcohol at 90° C., but it readily dissolves, on the contrary, in this liquid boiling and diluted with half its weight of distilled water. The solution which results from it possesses a fine red color.

A. This is a brown, uncrystallisable substance, possessing a very bitter taste, and very sparingly soluble in ether; soluble in boiling alcohol at 90° C.; soluble in distilled water, which it colors of a yellowish-red: it is soluble in concentrated nitric acid, producing a red color as beautiful as that resulting from the action of this acid on brucia. Sulphuric acid also dissolves it, but more slowly, and likewise assumes a very fine red color. Hydrochloric and acetic acids, as well as caustic potassa, also dissolve it very well, but they take a yellow color.

B. This substance, like the foregoing, is uncrystallisable; its taste is bitter, and it has a red color when in a thin layer, and black when in a mass. It is insoluble in ether and in boiling alcohol at 90° C. It dissolves very well in this latter liquid when diluted with water. It dissolves in distilled water, to which it communicates a beautiful wine-red color, which the acids render rather brighter, whilst caustic potassa turns it rather brown, and the subacetate of lead yellow.

Concentrated sulphuric and nitric acids dissolve this substance, as also does caustic potassa, acquiring a more or less deep yellowish-red color.

The experiments which constitute the subject of this memoir are still very incomplete. Most of the bodies whose existence I have noticed have not, probably, been obtained in the perfectly pure state. The new investigations are, therefore, necessary: they will form the subject of a second memoir, which I will terminate with some reflections concerning the nature of the phenomena which accompany these curious metamorphoses of the organic alkalis.

INVESTIGATIONS CONCERNING CREOSOTE.*

BY M. H. DEVILLE.

The studies concerning the resins and essences which the Academy has been kind enough to encourage, have led me to think that it is necessary to consider the action of fire on these latter as not being a purely disorganising action. This action would be, on the contrary, in my opinion, incapable of effecting a profound change in the state of combination of the substances which constitute a body so complex as a resin. As it is generally admitted that an essential oil, homogeneous or not, has given rise, by its alteration in the vegetable, to the resin, the action of the fire on the latter would furnish a principal product identical with the primitive essential oil, or at least isomeric with it; it is thus we may find, or at least recognize the essential oils from which benzoïn, guaiacum, and other resins are procured, in which these oils have entirely disappeared.

This hypothesis, applicable to a certain number of resinous substances, I have already verified as regards some of them: creosote again gives me an opportunity of returning to it. Indeed, all my experiments lead me to believe that creosote is nothing more than an essential oil, or a substance isomeric with it, produced in the distillation of the resinous matters contained in

* *Comptes Rendus*, No. 2, July 8th, 1844.

wood.* We find here the same circumstances in which gydroguret of guaïacyle is formed by means of guaiacum.

Creosote and hydroguret of guaïacyle have analogies which are never *wanting*. The same reactions, the same chemical and physical properties correspond in a remarkable manner, notwithstanding the difference of composition. The hydroguret of guaïacyle (C^{28} H^{16} O^4) may be regarded as an oxide of creosote, (C^{28} H^{16} O^2 = 2 volumes of vapor.)

Creosote colors blue a great quantity of water containing a trace of a salt of peroxide of iron; with the hydroguret of guaïacyle, the coloration is brown. Creosote represents, by its composition, alcohol of the benzoïc series. Bromine gives a crystallised acid with creosote, half of whose hydrogen is replaced by bromine, equivalent for equivalent.

Hydroguret of guaïacyle and creosote, treated by sulphuric acid and chromate of potassa, give rise to a salt of chromium analagous to tartrochromic acid. From the acid produced with creosote I extract a resin which appears to me very interesting for the verification of the hypothesis on which I found the formation of creosote in the distillation of wood.

Absolutely pure creosote is not colored in the air. It combines with alkalis and bases, as Reichenbach observed, and its solution is colored blue by the salts of iron. All these properties render it similar to hydroguret of salicyle, beside which it may perhaps be placed, by doubling its formula.

ARSENIC IN THE EARTH OF CEMETERIES.†

M. Ollivier d'Angers made the following communication to the Academy:—He had recently been engaged in a judicial inquiry which had involved an important medico-legal question, one on which M. Orfila had read a paper to the academy two years ago, viz., "the arsenic contained in the earth of cemeteries." M. Orfila stated in his memoir that arsenic being insoluble in water, it was impossible that a body buried in arsenical ground could become impregnated by that substance. This statement, the result of theory, had been confirmed by the case to which he alluded, and which was as follows:—A man lost his wife, and public rumor having accused him of poisoning her, the body was exhumed. An accurate analysis, howeverr, proved that she had died of organic lesions quite independent of the action of any poison. A married woman, who wished to marry this man, poisoned her husband, and on the *post mortem* examination being made, evident traces of arsenic were found. The woman was brought before the azzises, but owing to discussions between the medical witnesses, the trial was deferred to the ensuing session. The body of the poisoned man was again exhumed, and the viscera sent to Paris to M. Ollivier d'Angers, along with some of the earth of the grave. Arsenic was found in the liver through the means of Marsh's apparatus. It was also found in the earth. The authorities then had the body of the woman who first died again exhumed. It is worthy of remark that after the first exhumation the body accidentally fell out of the coffin into the grave, and was covered by arsenical earth. Not a trace of arsenic however was found in the body, although it had thus remained several months imbedded in arsenical earth. This case, therefore, confirms the prévisions of M. Orfila. It shows both that arsenic does exist in the earth in some localities, and that this circumstance does not render medico-legal researches more difficult, as the insolubiilty of the arsenic contained in the earth of cemeteries prevents bodies becoming impregnated with it.

On M. Roux asking what was the cause of the presence of arsenic in cemeteries, M. Ollivier referred him to M. Chevalier, who had written an important memoir on the subject.

M. Chevalier stated that in the department of the Vosges, where the fact mentioned by M. Ollivier had occurred, there are many mines of arsenic. The presence of arsenic in the ground of the cemetery is, therefore, to be attributed, probably, to the geological constitution of the soil. This is not the case with the ground of the Parisian cemeteries. A fact with which he had only recently became acquainted, confirmed M. Orfila's views. All the bones of the workpeople of a small town in which copper is wrought, found in the cemetery, contain copper; but copper is also found in the ground in which they lie. In order to ascertain whether the copper was primitively contained in the bones, or whether it was communicated from the soil, he sent for bones from other localities where copper is wrought, but where the earth does not contain that metal; he found that they were likewise impregnated with the metal.

M. Orfila recalled to the recollection of

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* It is thus explained how creosote varies in composition with the quality of the woods from which it is extracted, and why certain woods do n t yield it.

† From *The Lancet*.

the Academy that in his memoir he had proposed two questions: first—Can a body impart to the earth the arsenic which it contains? Secondly—Can earth, containing arsenic, poison, as it were, a body? The first question he then answered affirmatively, the second negatively. The fact related by M. Ollivier d'Angers proved that the results at which he had arrived were correct.

MEMOIR ON ALCOHOLIC FERMENTS.*

BY M. BOUCHARDAT.

The author proposes, in this memoir, more especially to make known two kinds of alcoholic ferments, which he distinguishes from beer yeast, and to notice the principal characters of the alcoholic ferments whose existence he admits. The following table presents a summary of the characters of these three kinds of ferments:—

FERMENT OF BEER (*fermentum cerevisiæ*†).	FERMENT OF DREGS (*fermentum fœcis*).	BLACK FERMENT (*fermentum nigrum*).
1. Globules sometimes perfectly round, but ordinarily ovoïd. These globules are not flattened like those of the blood, but they have a very regular spheroïdal form, like the albuminous globules of the brain. The diameter of these globules varied, in my observations, from $\frac{1}{91}$ to $\frac{1}{150}$ of a millimetre in diameter.	1. Globules most frequently perfectly round; some, however, are ovoïd; they are not flattened like those of blood, but they have a very regular spheroïdal form: they greatly resemble the albuminous globules of the brain. The diameter of these globules varies from $\frac{1}{214}$ to $\frac{1}{228}$.	1. Globules perfectly round; they are not flattened like those of the blood. The dimensions of these globules vary from $\frac{1}{228}$ to $\frac{1}{250}$ of a millemetre.
2. The greater number of the globules of beer-yeast are well isolated from one another; some, however, have on the side a smaller globule, which is not simply in juxta-position, but which appears to proceed from the large globule, and to be still dependant on it; some of the small globules are united to the large by a very evident elongation.	2. Almost all the globules of dregs-yeast are isolated. Some, however, have on the side a smaller globule, which is not simply in juxta-position, but which appears to proceed from the large globule, and to be dependant on it.	2. All the globules of black yeast are isolated; when they are connected, or when they have on the side small globules annexed, they are transformed, and no longer act as alcoholic ferments.
3. Color of the mass, uniformly whitish grey; each globule has granular contents.	3. Color of the mass, uniformly whitish-grey; each globule incloses lobulous contents.	3. Examined with the microscope, the globule presents a very distinct black circle. The color of the mass is uniformly blackish-grey. No granular contents are distinguished in each globule.
4. Insoluble in pure water; insoluble in water containing $\frac{1}{1000}$ of hydrochloric acid; soluble in concentrated hydrochloric acid, which assumes a beautiful violet color. In great part soluble in water containing 0·001 of hydrochloric acid, after having been bruised for a long time with grains of silica.	4. *Idem.*	4. *Idem.*

* *Comptes Rendus.*

† I have adopted, as a generic name, the old word *fermentum*. I have not admitted the names of *mycoderma* and *torula*, proposed by M. Demazière and Turpin, because they apply to a state of ferment in which this modified organised body has no action on a solution of sugar.

FERMENT OF BEER.	FERMENT OF DREGS.	BLACK FERMENT.
5. Ether removes from it 0·05 of a liquid fatty body, containing oleïne, stearine, and an oil which contains phosphorus among its elements.	5. *Idem.*	5. Ether removes from it 0·003 of a liquid fatty matter, containing oleïne and stearine, and an oil containing phosphorus.
6. Alcohol removes from it lactic and phosphoric acids, and extractive matters.	6. *Idem.*	6. *Idem.*
7. Composition :—Albuminous substances, but containing more oxygen, and containing also sulphur and phosphorus.	7. *Idem.*	7. *Idem.*
8. Essential properties :—Placed in a solution of sugar, at a temperature varying between 50° and 84° F., determines a brisk fermentation, which terminates in a few days, not being able to be exerted in liquors containing much alcohol. Is destroyed in the act of brisk fermentation.	8. Placed in a solution of sugar, at a temperature of from 50° to 54° F., determines a slow fermentation, which is complete only after 3 or 4 months ; it acts in liquors containing 16 per cent. of alcohol. Is not sensibly destroyed in the act of slow fermentation.	8. Placed in a solution of sugar, at a temperature of from 50° to 54°F., determines a slow fermentation, which is complete only after 6 months ; it acts in liquors containing more than 17 per cent. of alcohol. Is not sensibly destroyed in the act of slow fermentation.
9. Collected in ordinary beer.	9. Collected in a very strong beer.	9. Collected in a deposit of white wine.

The facts contained in this table, says M. Bouchardat, show that these alcoholic ferments differ from each other: firstly, in form, color, and dimensions, and in the contents of the globules; secondly, by the mode in which they decompose sugar; thirdly, by the medium in which they exist.

I designate them by the names of *beer-yeast*, *dregs-yeast*, and *black yeast*.

Dregs-yeast and black yeast are especially remarkable, because, by aid of a slow fermentation, they can determine the formation of richer alcoholic liquors than the most generous wines. In order to acquire information concerning the nature of ferments, I studied their proximate and elementary composition, and the action on these globules of water containing $\frac{1}{1000}$ of hydrochloric acid.

PROXIMATE COMPOSITION OF ALCOHOLIC FERMENTS.

The following is a list of the substances which enter into the composition of ferments :—

1. Proteïc animal matter, insoluble in alcohol, containing nitrogen, hydrogen, carbon, oxygen, sulphur, and phosphorus.
2. Nitrogenous matter, soluble in alcohol.
3. Solid fat.
4. Liquid phosphuretted fat.
5. Lactic acid, lactate of lime and soda.
6. Acid phosphate of lime, and acid phosphate of soda.

ELEMENTARY COMPOSITION.

The proteïc animal substance, which forms the essential part of the ferment, differs from caseïn, albumen, and fibrin by an excess of oxygen which is not less than 2 per cent.

ACTION OF HYDROCHLORIC ACID AT 0·001.

Water containing $\frac{1}{1000}$ of hydrochloric acid dissolves with facility, as I have shown albumen, caseïn, &c.; the alcoholic ferments completely resist this solvent action; they are partially dissolved in it when the globules are torn by pulverisation: these experiments prove to us that the proteïc matters of the globules of the ferment are constituted of two different substances: the one enclosed, soluble in acidulated water; the other enveloping, insoluble in that solvent.

I will describe an experiment which shows us the analogy of ferments with the globules of animals.

ACTION OF THE BRAIN OF AN ADULT MAN ON A SOLUTION OF SUGAR.

I took 25 grammes of the brain of an adult man, and put it into a quart of water and added to it 250 grammes of sugar. After 48 hours, the temperature being about 77° F., the alcoholic fermentation commenced and continued to progress regularly.

At first sight, one would be tempted to perceive here only a fact analogous to those noticed by M. Colin. This chemist, indeed, proved that the albumen of the egg, and several other organic matters, might become alcoholic ferments. But this is the difference between M. Colin's results and mine: albumen, put in contact with a solution of

sugar, at the temperature of 92° F., is converted into a ferment, whose action is very weak at the end of three weeks, whilst the cerebral mass of an adult acts, at the end of 48 hours, as an energetic alcoholic ferment.

The substance which composes the brain is formed by the union of globules of different kinds. Among these the most important are the albuminous globules, which present the microscopic appearance of the ferment of dregs, and which act like it on the solution of sugar; these globules are not constituted of pure albumen, as has hitherto been thought. Indeed, if we treat the cerebral mass of an adult with water acidulated with 0·001 of hydrochloric acid, this pretended albumen is not dissolved; to dissolve it, it is necessary previously to bruise it with silica. These experiments show us that the proteïc globules of the brain are formed, like the globules of ferment, of an envelope insoluble in acidulated water, and of an enclosed albuminous matter soluble in that vehicle.

If, instead of taking the cerebral mass of an adult animal, that of a newly-born animal be selected, if it be put into a solution of sugar, and if the mixture be exposed to a temperature of 77° F., alcoholic fermentation does not take place, but the mucous transformation is observed.

The reason of this difference is very simple. The envelopes of the brain of a young animal have not sufficient resistance, they are destroyed by endosmose in the solution of sugar, and, the globules no longer existing, alcoholic fermentation cannot take place.

NATURE OF THE GLOBULES OF ALCOHOLIC FERMENTS.

The globules of alcoholic ferments present the most complete analogy with the nervous globules of superior animals. When, in definite conditions, these vegetables ramify and are transformed into vegetable infusoria, they lose their characters as ferments; the spores themselves of these new vegetables do not possess the property of decomposing the solution of sugar.

EXPERIMENT ON THE DEVELOPMENT OF THE GLOBULES OF ALCOHOLIC FERMENTS.

I dissolved the whites of 4 eggs and 1 kilogramme of sugar in 4 quarts of water, containing 0·001 of hydrochloric acid. The liquors were filtered with the greatest care, and divided into two equal flasks. I added nothing to the first flask, and, after two months, the temperature varying from 59° to 77° F., alcoholic fermentation had not manifested itself. To the second flask I added an equally limpid solution of 10 grains of tannin in 100 grammes of water. An abundant precipitate was immediately formed, which, after 48 hours' exposure to a temperature of 77° F., was partly converted into globules of $\frac{1}{400}$ of a millimetre, acting absolutely with a solution of sugar like the ferment of *dregs*.

ON THE MULTIPLICATION OF THE GLOBULES OF FERMENT.

All chemists know, since the experiments of M. Thénard, that, when a solution of sugar is fermented with a sufficient quantity of globules of ferment, when the first fermentation is accomplished, the weight of the globules is considerably diminished. After a second fermentation they almost entirely disappear, and are replaced by an ammoniacal salt which is found in the liquid, and by the remains of microscopic vegetables, in which M. Thénard recognised the existence of ligneous matter; but this observation can be invoked only to establish the non-production of the globules of the ferment. It may be said, that these globules require two kinds of nourishment: sugar, to produce heat by its dédoublement, and nitrogenous matter, to furnish the elements adapted for their assimilation and reproduction. The following is the reply offered by experiment to this latter supposition:—

I took 1 kilogramme of sugar, 4 quarts of water, 50 grammes of yeast, and 200 grammes of white of egg dissolved in water by means of 0·001 of hydrochloric acid. The temperature being maintained at 68° F., the fermentation was promptly established, and continued to proceed with regularity for four days; being then slower, I collected the ferment, and I found its weight to be only 50gr.·5. There is beyond that a multiplication of 1 to 7 observed in the brewer's vat. The globules of ferment cannot, in any way, assimilate the albuminous matter, any more than the sugar. On the other hand, I have repeated the above experiment by substituting for the 200 grs. of albumen 100 grs. of fresh gluten, also dissolved in water acidulated with 0·001 of hydrochloric acid. I employed also 50 grs. of yeast. The fermentation proceeded regularly for four days. The ferment collected at this time did not weigh more than 49gr.·2. It is evident that the globules of the ferment do not assimilate more of the solution of sugar than the solutions of albumen and gluten. Does it not follow from these experiments, that, if we find in the brewer's vat 7 of ferment, only one having been put in; this must be owing only to this 1 part of ferment having met with proteïc substances which, placed in a fermenting medium, are proper for giving rise spontaneously to globules of ferment; the same as in the must of grape, without having added ferment, we find a considerable quantity of it?

NOTE ON THE RESIN ICICA.*

BY M. F. SCRIBE.

This resin was preserved in the collections of the Museum of the *Jardin des Plantes*, under the name of storax of Cayenne; but it has neither the characters nor the composition of the balsam generally called in France storax, *Styrax calamite*, which is extracted by incisions into the *Styrax officinale*.

The study of this product was confided to me by M. Dumas, to whom M. Adolphe Brongniart had sent it. The analyses which I am about to detail were performed in his laboratory.

It occurs under the form of small masses, or opaque grains, of a yellowish-white, and mixed with some remains of bark. The odor is sweet and very agreeable, heat and pulverisation slightly increasing it. They are friable, break between the teeth, and then present only a very feeble taste. Their fracture is white, traversed by some yellowish veins. They abandon nothing to water, and do not disengage any volatile substance when distilled with it.

It is of all resins the least soluble in alcohol. It requires, in order to be completely held in solution, 55 times its weight of cold alcohol of 36 degrees, 15 times its weight of boiling alcohol, and 3½ times its weight of essence of turpentine, at the ordinary temperature. The action of these solvents is very slow without heat; they must be heated at first to accelerate the solution, then cooled, and the excess of resin separated.

It presents to analysis three peculiar resins, distinguished from each other by their composition and solubility, but all three possessing complete neutrality.

These three resins are obtained separately by having recourse to their different degrees of solubility in alcohol. We commenced by completely dissolving the resin icica in boiling alcohol; the solution, after having been filtered warm, in order to free it from the ligneous matters, held in suspension in cooling, allows breane to crystallise, whilst the supernatant liquor retains in solution icicane and colophane.

BREANE.

This substance, separated from alcohol, re-crystallised, and dried at 238° F., *in vacuô*, furnished by analysis, by means of oxide of copper and the current of oxygen, the following formula, expressed in equivalents:—

$$C^{10}\ H^{61}\ 3\ HO.\dagger$$

which expresses in hundredths:—

Carbon	84·06
Hydrogen	11·75
Oxygen	4·21
	100·00

ICICANE.

The mother-liquors of the foregoing products contain, also, mixtures of breane, icicane, and colophane. They are separated from one another by slightly concentrating the liquor, rejecting the first portion that crystallises, that is to say, impure breane, and decanting the alcoholic liquor, from which a crystalline product is again extracted by evaporation. This is the second resin, icicane, whilst colophane, much more soluble, remains dissolved in the last mother-liquor.

The icicane, which is purified from the uncrystallisable substances by several washings with alcohol, dried at 248° F., *in vacuô*, furnished by analysis oxide of copper and the current of oxygen, the following formula:—

$$C^{160}\ H^{137}\ O^{9},$$

which requires, in hundredths:—

Carbon	82·12
Hydrogen	11·71
Oxygen	6·17
	100·00

This formula is decomposed into two others:—

$$C^{80}\ H^{64}\ 3\ HO + C^{80}\ H^{64}\ 6\ HO.$$

Icicane may, therefore, be regarded as a conjoint product, formed by the association of a multiple hydrate of carburetted hydrogen with essence of turpentine, and identical with the breane studied above, with another hydrate of the same multiple, analogous to that which MM. Dumas and Péligot obtained from essence of turpentine abandoned to itself in contact with dilute nitric acid.

COLOPHANE OF THE RESIN ICICA.

Finally, the last mother-liquor of the foregoing product, after having abandoned all crystallisable products, deposits a small quantity of colophane, a yellow, amorphous substance, fusible below 212°, much more soluble in alcohol, than either of the foregoing products. Its concentrated alcoholic solution evinces some acidity with litmus; but it does not dissolve in the alkalis, and possesses all the other characters of neutral substances. In the fused and dry state, it furnished by analysis with oxide of copper and the current of oxygen, the following results:—

* *Comptes Rendus*, No. 2, July 8, 1844.

† C = 7·0; H = 12·5.

0·436 of matter gave 0·420 of water, and 1·246 of carbonic acid; which represents, in hundredths :—

Carbon	77·93
Hydrogen	10·69
Oxygen	11·48
	100·00

These numbers approach those which represent colophane ; the latter product would, therefore, be expressed by the formula of colophane :—

$C^{40} H^{30} O^4$, or $C^{40} H^{30} O^5$.

To sum up, the resin icica contains three neutral resins, of which two are crystallisable, and the third uncrystallisable.

The first ranks in the group of sub-resins of Bonastre, and presents a composition identical with that of cholesterine.

The second, more soluble, seems to be a variety of sub-resin, different from the foregoing. Its simultaneous existence has, hitherto, been demonstrated only in the resin of the palm-tree, *Sideoxylon andicora*, and in the resin of the genus icica of Guiana.

Both may be represented as hydrates of essence of turpentine.

The third is uncrystallisable, much more soluble, and much more fusible than the foregoing. Its composition resembles that of colophane.

ON THE PROVISIONS FOR THE SUBSISTENCE OF LIVING BEINGS EVINCED IN THE STRUCTURE OF THE OLDER ROCKS, AND IN THE PHENOMENA WHICH THEY EXHIBIT*.

BY PROFESSOR DAUBENY.

He began by observing, that as the attention of philosophers was that evening directed to the moon by the eclipse, he thought it might not be inappropriate to illustrate the line of his argument by reference to the supposed structure and condition of that satellite. Supposing, then, a human being to be transported to the surface of the moon, and to contemplate her in that condition in which astronomers represent her to us as existing —namely, as destitute both of seas and of an atmosphere, with vast cup-shaped mountains, the craters of volcanos, vomiting forth steam and smoke, and emitting volumes of noxious gases, would he not conceive the globe in question abandoned to those destructive agencies which he saw in such intense activity, rather than that it was in a state of preparation for the abode of beings constituted like himself? Yet what the moon now is, geology leads us to infer that the earth has formerly been; and from the phenomena now presented to us by it, we may infer a train of events to have occurred which, whilst they must have been at the time utterly destructive to all kinds of life, nevertheless prepared the earth for the reception of living beings, and rendered it a more agreeable abode to those which, like man, possessed a feeling of the sublime and beautiful.

The Professor then proceeded to point out the provisions for the future existence of living beings which were made in those earlier stages of the history of our globe, when it appears to have been in a condition as chaotic as that of the moon at present. Those ingredients of the crust of the earth which seemed designed more especially for the purposes of living beings, may be distinguished, into such as minister to some object of utility for man in particular, and such as are essential to animals and vegetables in general. The former class, being commonly more or less poisonous, occurs in veins for the most part existing in the older rocks, being stored, as it were, out of the way, before living beings were created. Such are copper, tin, lead, mercury, and other of the metals. The latter, on the contrary, are more generally diffused through the strata of the globe, although, for the most part, in comparatively minute proportions. Amongst the latter are the fixed alkalies, which are present in all felspathic and other rocks of igneous origin, from which they are slowly disengaged by the action of air and water, in proportion as they are required for the necessities of living beings ; whereas if they had been present in a readily soluble form in the earth, they would have been washed into the sea before they could have been made available for such purposes.

Another essential ingredient in the structure of animals is phosphoric acid, which appears peculiarly suited for entering into the organisation of a living body, by the readiness with which it undergoes changes in its properties by the character of its crystallisation, and (in the case of the bone-earth phosphate) by the association of the *bibasic* with the *tribasic* salt, in equal proportions, which causes each to counteract the tendency to crystallise in the other, and thus renders it more capable of accommodating itself to the delicate texture of the animal fibre. The question then is, whence do animals and vegetables obtain this necessary ingredient? Dr. Daubeny and others have detected mi-

* *Royal Institution*, May 31, 1841.

nute proportions of it in many of the secondary rocks, but as these are derived from more ancient ones, it ought to be present likewise in them. Now we know at least of one instance in which this material occurs in considerable abundance in a rock which, so far as our observations at present extend, seems to have been formed anteeedently to animal life. This is the slate rock of Estremadura, in Spain, where, near the village of Logrosan, it had been pointed out as existing many years ago.

Exaggerated reports had, however, been spread as to its extent, for Prof. Daubeny, in a visit he paid last year to the loeality, found that it formed only one solitary vein, generally about ten feet wide, and extending along the surface for about two miles. It also contains a eonsiderable per-centage of fluate of lime, and as this ingredient appears, from recent experiments of the author of this paper, to be present generally in bones, both reeent and fossil, it would seem that it was treasured up by nature, as one of the requisite materials for the bony skeletons of animals. Provision seems to have been also made for supplying living beings with their volatilisable, as well as with their fixed ingredients.

The attraction of all porous and pulverulent bodies for gases, may explain the manner in whieh the latter are brought into contact with the secreting surfaces of plants; but it must be remembered, that of the four elements which together constitute those parts of a living body whieh are dissipated by heat, oxygen alone can be directly absorbed. Of the three remaining, hydrogen must be presented in the form of water, nitrogen in that of ammonia, and carbon in that of carbonie aeid.

Now volcanos appear to have been the appointed means of providing both of the two latter in quantities sufficient for the food of living beings, for both ammonia and carbonie acid are evolved in immense quantities from all voleanos, as the Professor showed by appealing to the case of Vesuvius and its neighborhood, as well as to that of other voleanie vents.

The produetion of ammonia in the interior of the earth might, he contended, be readily explained upon the principles of that theory of volcanos whieh he had for many years adopted, and which was founded on the great diseovery of the metallic bases of the earths and alkalies, whieh we owe to the genius of Sir Humphrey Davy. Once admit that those substances which we see brought up to the surface, in the shape of lavas and of ejected masses, exist in the interior of the globe wholly, or partially, in an unoxidised condition, and that first sea-water, and afterwards atmospheric air, gradually find aceess to them through eertain crevices, and all the phenomena of a volcanic eruption may be shown to follow; namely, the intense heat, the eseape of muriatie acid, the copious deposits of sulphur, the volumes of carbonic aeid, and, lastly, the salts containing ammonia; for if naseent hydrogen, disengaged from water decomposed by meeting with the alkaline metals, were brought in contact with nitrogen under a high pressure, there is every reason to believe that ammonia would be the result. Thus, the very agents of destruction, whieh seem at first sight to be antagonist forees to every kind of creative energy, have been, in fact, the appointed means of supplying the materials out of which all organised beings are fashioned. But though the materials for our subsistenee are thus provided, it does not follow that man is not to exert himself in order to obtain larger supplies than are naturally placed before him. On the contrary, his business is to husband his resources, and to apply them to the best aeeount.

Alluding to a late work of Prof. Liebig's, he contended that this eminent chemist eould not have meant to discourage the preservation of the volatile ingredients of our manure-heaps, whilst insisting on the paramount importance of supplying those which are fixed. It is true that nothing is lost, for the excrementitious matters which are washed into the sea increase the luxuriance of the marine vegetation, whieh affords food for a large number of fishes, whieh again encourage a greater amount of sea-fowl, which finally deposit, what had been originally derived from the depths of the sea, on the islands of the Paeific, as guano.

Thus England eontrives, by means of her navies, to bring baek from the opposite extremity of the globe, the very material which she originally wasted by the defeetive arrangements of her large towns. This, however, is a very eireuitous mode of proceeding, and the true seeret of all agrieultural improvement is, to apply the means at our disposal, so as to produce a return for the toil expended in the shortest possible space of time.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE PRECIPITATION OF METALS BY OTHER METALS.*

BY M. BECQUEREL.

(Concluded from page 357.)

DEPOSITION OF SILVER OR SILVERING.

Silver is easily deposited with adherence on copper and other metals, by following the general method. It is known that chloride of silver is soluble in a saturated solution of common salt, but in very small proportion, since the quantity of silver united with the chlorine represents only $\frac{17}{10000}$ of the weight of salt employed at the temperature of 50° F.; but the solvent power augments with the temperature, for, at about the boiling heat, it is four times more considerable. It is also known that, when a plate of iron, zinc, or copper is put into water saturated with chloride of silver, at the ordinary temperature, the chloride of silver is decomposed, and the silver is deposited in more or less attenuated particles, and without adhering to the metal. The results which I obtained with platinum and other metals led me to think that, by aid of a sufficient temperature, and with a saturated solution of chloride of silver and common salt, the silver might be made to adhere to copper. Indeed, at the temperature of about 160° F., a dead silvering was obtained, which assumed the metallic lustre by burnishing. By operating at the temperature of ebullition, the silvering verges on black; it is therefore necessary to restrain the temperature within certain limits, which should vary according to the nature of the alloys of copper, if we wish to obtain a silvering combining the desired conditions. The quantity of silver deposited was determined in the following manner:—A sheet of red copper, 50 millimetres long and 23 broad, was taken; this sheet having been weighed before and after immersion in the bath, presented an excess of weight equal to 0gr.·003. Now, as the silver is substituted for the copper in atomic proportion, we find, by means of the calculation pointed out in speaking of platinum, that the substance silvered by immersion contains 0gr.·0164 per square decimetre. The process which I have just described, and which is the result and application of a general principle, has some distant relations to that employed in certain arts, and of which M. Dumas has given a good description in the *Annales de l'Industrie Française et Etrangère*, t. i., p. 311. We here give this process for comparison with that above explained:—"Suppose that we have dissolved," says the author, "one ounce of silver in nitric acid, and that the solution has been precipitated by means of hydrochloric acid or common salt, the chloride of silver is washed and mixed, while still moist, with four pounds of common salt, two ounces of sal-ammoniac, half a pound of glass, two ounces of nitrate of potassa, 1½dr. white oxide of arsenic, and a ¼ of a pound of sulphate of iron; the mixture being made, the pieces are cleaned with nitric acid; the latte should be very concentrated: the object should remain in it only a few moments, and as soon as it has acquired a very vivid golden tint, it is withdrawn, and washed in a great quantity of water. The object being cleaned, a small quantity of the above mixture is put into boiling water and is entirely dissolved; and then if the object is immersed in it, it is immediately covered with a very brilliant layer of silver, without stain or crystalline asperities. The most remarkable part of this process consists in the employment of chloride of silver; the sal-ammoniac and glass salt, which consist almost entirely of alkaline chloride, have for their object to render the chloride of silver soluble in water, by its transformation into double chloride, which is soluble. If the chloride of silver were not dissolved, the silver would be deposited on the brass under the form of a gray or even blackish powder, and always very dull. If we substituted for the chloride a salt soluble of itself, such as the nitrate, the result would be still worse. It is probable that the quantity of alkaline chloride is too great; but this circumstance is of little importance."

It appears, according to the opinion of M. Dumas, that the sulphate of iron, in reacting on the nitrate of potassa and common salt, liberates a small quantity of nitric and hydrochloric acid, which produce a small quantity of aqua-regia, which brings to the state of white chloride the portion of violet sub-chloride, which is quickly produced in the mixture by the action of light. The oxide of arsenic being reduced at the same time as the chloride of silver, there is then deposited on the brass a subarseniuret of silver. If too much oxide of arsenic were added, the silver would take a leaden color. The object of the cream of tartar is only to clean the brass.

* *Comptes Rendus.*

By comparing this method with that which I have described, we find essential differences. I operate with a saturated solution of chloride of silver and common salt, at nearly a fixed temperature, whilst in the process indicated in the *Annales de l'Industrie*, a solution is made use of in boiling water, of a small quantity of a mixture of double chloride of silver and soda, and different other salts. Only, in both, the employment of heat is necessary; finally, my solution is neutral, and the other is alkaline.

DEPOSITS OF COPPER.

This metal does not present any difficulty in being precipitated with adherence on various metals by employing the solution of double chloride in definite proportion. It is known, moreover, that for coppering iron, it is sufficient to steep a well-cleaned plate of this metal for a few moments in a concentrated solution of sulphate of copper, or else to prolong the immersion in a dilute solution. In order to obtain the deposit of copper on metals which are not very oxidisable, it is necessary to touch the object immersed in the solution of double chloride, at a suitable temperature, with a piece of zinc, likewise immersed in the solution.

DEPOSITS OF ANTIMONY.

Copper is covered with the greatest facility by operating with the solution of double chloride, at the temperature of 160 to 170° F. The metal deposited has a violet gray aspect.

DEPOSITS OF BISMUTH.

Bismuth is very easily deposited on copper-plates, always with the contact of zinc. The deposit has a slightly yellowish white aspect; it is dull, and takes a polish under the action of a brush and English rouge.

DEPOSITS OF TIN, OR TINNING.

Copper and iron are readily tinned in the double chloride of sodium and tin, diluted at the temperature of 160° F. "Lustre" and "dead" are immediately obtained; but the contact of zinc is indispensable.

When once the layer of tin is deposited on the copper, if the contact of the zinc be maintained, much tin is deposited, but which does not adhere; thus the subsequent molecules are no longer in the condition necessary for aggregating with those already deposited. The tinning thus obtained is satisfactory, and may be employed in the arts.

DEPOSITS OF LEAD, OR LEADING.

The leading of iron may be directly obtained by steeping a plate of this metal newly cleaned in a solution of acetate of lead; but if it be wished to effect its deposition on copper with the solution of double chloride, the contact of zinc must be employed, because copper does not possess the property of decomposing the salts of lead. Although this metal deposited on copper, which has no action on the solution of double chloride, nevertheless, it is not possible to cover with it the electro-negative metals with the aid of the contact of zinc. This very remarkable peculiarity will be discussed at the end of this memoir. The lead deposited has not its usual grayish color; when it is in mass, and when its surface is brightened, it is whitish.

DEPOSITS OF NICKEL AND COBALT.

The experiments detailed, at the commencement of this memoir, show that these two metals should be deposited with facility on copper, and even on iron, on account of their tendency to adhere to zinc in the decomposition of their salts by aid of heat. The simple immersion of copper, in the double chloride of cobalt or nickel, is sufficient for reducing these two metals to the metallic state; but the layer of metal deposited has little adherence. By touching with a piece of zinc, drawn out to a point, the metal deposited becomes brilliant and very adherent; the layer adheres to it sufficiently powerfully to bear burnishing either with English rouge and leather, or with a burnisher.

The lustre resembles that of silver. It is difficult to distinguish nickel from cobalt by the color. The object covered do not act on the magnetic needle, even on that subtracted from the action of terrestrial magnetism. This negative effect can arise only from two causes: either the metal deposited must be in too thin a layer to act on the magnetic needle, or else the adherence to the copper constitutes an alloy in which the properties of the deposited metal are modified. One proof that the layer is in a particular state is, that, although its parts adhere to one another in consequence of their action on the copper, nevertheless, the molecules which are deposited, by employing the simple contact of zinc, can no longer be aggregated. The action exerted by the copper would, therefore, modify the physical properties of the metal deposited. The zinc should touch only at certain points, for, if the surface of contact has a certain extent, the object becomes black, especially round the point of contact. This is a reason for avoiding the immediate contact of the zinc; it is accomplished by connecting the latter with the copper by means of a copper wire.

If it is wished to employ contact directly,

the reverse of the surface to be covered must be touched. I have said that the metallic layer does not act on the metallic needle ; but we may give to the layer of metal deposited a thickness sufficient for the reaction to be manifested. I will speak of it when I show to what point it is possible to use solutions of double chloride heated from 140° to 176° in order to augment the thickness of the deposits. I will also remark that with nickel as with cobalt, the effects of deposition vary with the nature of the brass ; that some give the most satisfactory effects, whilst others powerfully resist deposition ; these are those which contain a greater proportion of zinc. With respect to red copper, it is always employed with advantage. When copper is not equally covered, which is owing to imperfect cleansing, all these parts must be touched with the point of zinc or a piece of zinc drawn out to a point; by this means an uniform deposit is obtained. For cobalt and nickel, it is necessary to operate at a temperature near that of ebullition.

DEPOSITS OF IRON.

From what I have just said of the oxidisable metals, such as the two foregoing, in the precipitation with adherence, it will be conceived that iron should act in the same manner, that is to say, should be deposited on copper, and, probably, on other metals, by the contact of zinc. Experiment has fully confirmed this anticipation. Iron deposited on brass assumes its own color.

TINNING OF COPPER AND IRON.

Copper and iron are easily covered with tin in such a manner as to give a good tinning. The operation is the same as with the other results. It is one of the most satisfactory operations.

OF THE INTERVENTION OF MORE OR LESS INTENSE CURRENTS FOR OPERATING METALLIC DEPOSITS.

We have seen that the decomposition of the double chlorides by immersion, at a suitable temperature, with an immediate and adherent deposition of the metal might be operated in two ways, either by plunging only the plate of metal destined for receiving the deposit into a neutral solution of double chloride at a temperature varying from 140° to 212° F., or thereabouts, according to the nature of the metal, or when the latter is not sufficiently oxidisable to decompose the solution, by employing the contact of zinc. It may readily be conceived that if we employ the action of an electro-chemical apparatus composed of several couples, in order to give thickness to the metallic deposit, the effects will vary in these two cases. In the first, it may happen, and it is most frequently observed, that the metal serving as the negative electrode is not rendered by the action of the current sufficiently electro-negative for the solution not to act upon it. In this case, the counter-current resulting from this reaction will act on that of the pile, and nearly the same effects will be obtained as if the precipitating metal remained in the solution. This happens with respect to copper, with relation to the solution of double chloride of platinum and potassa, and solutions of palladium, rhodium, iridium and other metals. It is not the same in the second case, since the metal serving as the negative electrode is not attacked by the solution and is covered by a metallic layer by the simple contact of zinc ; it follows, *à fortiori*, that if we employ, instead of the current resulting from this contact, the action resulting from several couples, the deposit will necessarily increase in thickness. This is observed with the solutions of cobalt, nickel and antimony relative to copper and other metals on which the metals which enter into solution are deposited by the sole contact of zinc. A plate of copper was taken, whose weight and principal dimensions were as follows :—

Weight	17·150
Length	50· millimetres.
Breadth	20· ,,
Surface in sq. millimetres	1·150

This plate, put in connection with the pole of a voltaïc apparatus, composed of six pairs, and acting with water slightly acidulated with sulphuric acid, was plunged into a dilute solution of double chloride of nickel and sodium, similar to that which was previously made use of. This circuit was closed with a platinum wire in connection with the positive pole. Five minutes after, the plate was withdrawn from the solution, washed, dried, and weighed ; an increase of weight of 3 milligrammes was found. The plate then acted on the magnetic needle ; again operated on for 5 minutes, an increase of 4 milligrammes was found : in all, during 10 minutes, 7 milligrammes. These 7 milligrammes were spread on a surface of 2,300 square millimetres ; that is to say, there were nearly 3 centigrammes of nickel per square decimetre. The salts of cobalt gave sensibly the same results was deposited.

The copper which decomposes, as is known, the solution of chloride of silver, with adherence of the metallic layer, was made the subject of an experiment. A plate of 50 millimetres long and 23 broad, increased, under the influence of the current, 0 gr. ·004—a result which shows that about 0·016 per square decimetre was deposited.

With red copper, and a solution of double

chloride of tin and sodium, there was obtained for a surface of 2,300 square millimetres, an increase in weight of 8 milligrammes in ten minutes, which gives 0 gr. ·0328 of tin per square decimetre. Iron was covered in the same time with only 0 gr. ·025 of tin.

CONCLUSIONS.

In the process which I have just described, there are three things essential to be considered: the composition of the liquor, into which enter an alkaline chloride and a metallic chloride, in equal atomic proportions; the temperature of the solution; and the adherence of the precipitated metal, which ceases when the layer has acquired a certain thickness, although aided by the voltaïc action resulting from the contact of the objects with the zinc. How is it that a double compound operates the decomposition of the metallic salt with adherence of the deposit more easily than by employing a simple metallic solution? In reply to this question, we must start from this point, that the metallic chloride, being combined with the alkaline chloride, has already lost a portion of its affinities; whence it follows that its action, being less powerful on the precipitating metal, the molecules of the precipitating metal do not precipitate so tumultuously as if a simple solution had been used. Besides, the solutions of alkaline chloride increase the conducting power of metallic solutions, which contributes also to give additional energy to the electro-chemical actions.

The action of heat has already been examined at the commencement of this memoir. I will here resume what I have said on that subject.

Increase of heat augments the conducting power, and favors the decomposition by dilating the body, and allows the deposited molecules to be introduced rather more deeply into the molecular interstices.

The causes of adherence, in this case, are the same as those which preside over the combination of the precipitating metal with the precipitated metal; the force of aggregation, proper to the molecules of the precipitated metal, does not contribute to it; for the new molecules, when the surface is covered, cannot be aggregated with each other. These causes are so identical with those which produce the combination, that, if the cohesion do not throw any obstacle in the way, this combination would be effected because the electrical states of the elements present are the same as if it should take place.

I have endeavored, in this memoir, as the Academy may have seen, to treat, in the most general manner, of the deposit of a non-alkaline metal or metals, sometimes with the aid of voltaïc action. This question is interesting, not only as regards molecular actions, but also with relation to applications in the arts: with respect to the intervention of voltaïc action, it is often determinable, as an example has shown us with regard to copper, with relation to the solutions of cobalt and nickel. In this case, the copper being the negative pole, one might have thought that the action was solely produced by the chemical action of the electricity disengaged in the reaction of the solution on the zinc; but the want of coherence of the molecules of metal deposited, when the layer has acquired a certain thickness, evidently shows that in the first moments of deposition the action of copper as regards the action of cobalt or nickel, although existing, is not sufficiently strong to decompose the solution of this latter metal; the contact of zinc, however, suffices for effecting it, and for producing an adherent deposit. What I have said of the deposits of cobalt and nickel applies, also, to antimony, &c. It is in the study of phenomena of this kind that we can best study the very numerous, varied, and interesting relations which connect affinities and electrical forces—relations which should never be lost sight of in all chemical operations in which three bodies are present; for there may result, if we avail ourselves of the electrical effects produced in this case, a new energy in the chemical forces which were formerly used only in a few peculiar cases, and which is now turned to account in chemical actions, and molecular actions in general, like heat, one of the most important auxiliaries of affinities.

Finally, I will terminate this memoir by remarking, that all the facts which are here detailed rest on a simple principle, namely, the employment of perfectly neutral double metallic and alkaline chlorides, at a temperature varying between 140 and 212° F. This principle is fertile in applications, since it extends to nearly all the nonalkaline metallic salts. If I have not been able to give the law which connects all the phenomena, I have at least presented the general principle on which it is based; one law in fact connects the facts, and in the last analysis sums up all; but the principle is the point of departure of the investigations which lead to its discovery. The study of the principles should therefore precede that of the laws, and it is that which has occupied my attention.

In another memoir I will examine the action which all the metals, in the conditions in which I operated, undergo with regard to the solutions of titanium, chromium, and

uranium, as well as the formation of alloys with or without the influence of metallic contact

ON RECENT IMPROVEMENTS IN THE MANUFACTURING AND SILVERING OF MIRRORS.*

BY PROFESSOR FARADAY.

1. The manufacture of plate-glass. 2. The *ordinary* mode of silvering mirrors. 3. The *new* method of producing this result, lately invented and patented by Mr. Drayton.—1. Mirrors are made with plate-glass.

Mr. Faraday described glass generally as being essentially a combination of silica with an alkaline oxide. The combination, however, presents the character of a solution rather than of a definite chemical compound, only it is difficult to affirm whether it is the silica or the oxide which is the solvent, or the body dissolved. From this mutual condition of the ingredients, it follows that their product is held together by very feeble affinities, and hence, as was afterwards shown, chemical reagents will act upon these ingredients with a power which they would not have were glass a definite compound. Mr. Faraday noticed, that as glass is not the result of definite proportionals, there are many combinations of materials capable of producing a more or less perfect result. Each manufacturer, therefore, has his own recipe and process, which he considers the most valuable secret of his trade. It is, however, well known, that the flint-glass maker uses the oxides of lead and of sodium, the bottle-glass maker lime (oxide of calcium), and the plate-glass maker, in addition to soda, has recourse to arsenic.

Mr. Faraday then adverted to the corrosions which take place in the inferior qualities of glass, owing to the feeble affinity with which their indgrcients are held together. He stated, that from the surface of flint-glass a very thick film of soluble alkali was washed off by the first contact of liquid, leaving a fine lamina of silica, the hard dissoluble quality of which protected the substance which it covered.

If, however, this crust of silica chanced to be mechanically removed, the whole of the glass became liable to corrosion, as in ancient lachrymatories and other glass vessels. Mr. Faraday illustrated this by the corroded surfaces of two bottles, one obtained from a cellar in Threadneedle-street, where it had probably remained from the period of the great fire of London, another from the wreck of the *Royal George*.

A still more striking instance of the instability of glass as a compound was exhibited by formations in the interior of a champagne bottle, which had been filled with diluted sulphuric acid. Inthis case the acid had separated the silica from the inner surface of the glass, and formed a sulphate with its ingredient, lime. The result was, that the bottle became incrusted internally with cones of silica and sulphate of lime, the bases of which, extending from within outwards, had perforated the sides of the bottle so as to cause the escape of the liquor it contained. Mr. Faraday referred to the long period of annealing (gradual cooling) which glass had to undergo as a necessary consequence of glass wanting the fixity of a definite compound. He concluded this part of his subject by describing the mode of casting plates, and the successive processes which gradually produce the perfect polish of their surfacc.

2. Mr. Faraday next exhibited to the audience the mode of silvering glass plates as commonly practised. He bade them observe that a surface of tinfoil was first bathed with mercury, and then flooded with it. That on this tinfoil the plate of glass, having been previously cleansed with extreme care, was so floated as to exclude all dust or dirt; that this was accomplished by the intervention of $\frac{1}{8}$ in. of mercury (afterwards pressed out by heavy weights) between the reflecting surface of the amalgam of the mercury and the glass; and that when the glass and amalgam are closely brought together by the exclusion of the intervening fluid metal, the operation is completed.

3. The great subject of the evening was the invention of Mr. Drayton, which entirely dispenses with the mercury and the tin. By that gentleman's process, the mirror is, for the first time, literally speaking, *silvered*, inasmuch as silver is precipitated on it from its nitrate (lunar caustic) in the form of a brilliant lamina. The process is this: on a plate of glass, surrounded with an edge of putty, is poured a solution of nitrate of silver in water and spirit, mixed with ammonia and the oils of cassia and of cloves. These oils precipitate the metal in somewhat the same manner as vegetable fibre does in the case of marking ink, the quantity of oil influencing the rapidity of the precipitation.

Mr. Faraday here referred to Dr. Wollaston's method of precipitating the phosphate of ammonia and magnesia on the surface of a vessel containing its solution, in order to make intelligible how the deposit of silver was determined on the surface of clean glass not (as in Dr. W.'s experiment) by mechanical causes, but by a sort of electric affinity.

* *Royal Institution*, June 7, 1844.

This part of Mr. Faraday's discourse was illustrated by three highly striking adaptations of Mr. Drayton's process. He first silvered a glass plate, the surface of which was cut in a ray-like pattern. 2nd. A bottle was filled with Mr. Drayton's transparent solution, which afterwards exhibited a cylindrical reflecting surface. And 3rd. A large cell, made of two glass plates, was placed erect on the table, and filled with the same clear solution. This, though perfectly translucent in the first instance, gradually became opaque and reflecting; so that, before Mr. Faraday concluded, those of his auditors who were placed within view of it, saw their own faces, or those of their near neighbours, gradually substituted for the faces of those who were seated opposite to them.

ON THE PURIFYING OF COAL GAS, AND THE APPLICATION OF THE PRODUCTS THEREBY OBTAINED TO AGRICULTURAL AND OTHER PURPOSES.*

BY MR. A. ANGUS CROLL.

The process consists in passing the gas through a solution of sulphuric acid, of the strength of two and a half pound of oil of vitriol to 100 gallons of waters and by a continuous supply of acid, so that the proper amount of free acid might be always kept in the vessel, the whole of the ammonia in the gas was abstracted, preventing the corrosive effect of this impurity on the fittings and meters through which it was transmitted, and rendering the gas capable of being used in dwelling-houses, and also enabling the gas companies to use dry lime, instead of wet lime purifiers without producing any nuisance on the opening of the vessels, by which a considerable saving was effected, while at the same time sulphate of ammonia of great purity is obtained, and of such a strength, that the evaporation of one gallon produces eighty ounces of this valuable salt, instead of fourteen ounces, which was the quantity rendered under the former process.

The author concluded by showing the advantage to agriculture by the application of this produce; he stated that various experiments upon an extensive scale had been tried with this manure with great success; one example will suffice for giving an idea of its powers. One half of a wheat field was manured with sulphate of ammonia at the rate of 1¼ cwt. to the acre, and at a cost of 1*l.* 2s., the other half with the ordinary manure; the latter produced only 23¾ but the former under the treatment of sulphate of ammonia produced 32¾ bushels. In the discussion which ensued, in which Professor Graham, Mr. Cooper, and many members took part, the advantages of the system were confirmed, and the necessity for its extension insisted upon.

The various modes of purifying gas, and the value of the products obtained for agricultural purposes, were canvassed at length. It was stated that seeds steeped for 40 hours in a solution of 1 pound of sulphate of ammonia to 1 gallon of water, sown in unmanured land, produced a heavy crop, and remained green during a dry season, when every other kind of vegetation became yellow and withered. Another remarkable feature was, that faded flowers when plunged in a weak solution of sulphate of ammonia, were in a short time restored, and that plants watered with it attained extraordinary health and beauty. The great loss resulting from the leakage of the gas through the joints and the pores of the cast iron pipes, was incidentally mentioned, and it was stated that in some instances it had amounted to from 25 to 75 per cent. of the total quantity produced.

* Read before the Institute of Civil Engineers, June 11, 1844.

COMPARATIVE ANALYSIS OF THE ALIMENT CONSUMED AND EXCREMENTS RENDERED, BY A TURTLE-DOVE, UNDERTAKEN IN ORDER TO INVESTIGATE WHETHER THERE IS AN EXHALATION OF NITROGEN, DURING THE RESPIRATION OF GRANIVOROUS ANIMALS.*

BY M. BOUSSINGAULT.

The investigations which I am about to detail were made with the view of ascertaining whether the granivora emit, during the act of respiration, nitrogen, arising from their organism; in other words, it has been proposed to examine whether an adult bird, regularly fed, and whose weight does not increase, renders, in its evacuations, the whole of the nitrogen contained in the aliments which it has consumed.

This emission of nitrogen is now generally admitted, in consequence of the experiments of Dulong and Despretz. Some years ago, I was led to a similar conclusion in deter-

* *Comptes Rendus.*

mining, by elementary analysis, the composition of the nourishment taken and that of the products rendered by the horse and the cow; nevertheless, as in the application of the precepts of theory to the economy of manures, it is of extreme importance to know whether there is really a portion of the nitrogen of the aliments consumed lost for the animal production and dung, I thought that I ought to study the question anew by applying my investigations, not to the larger herbivora, but to a bird which, from its small size and the nature of its evacuations, allowed a greater degree of precision to be hoped for. The turtle-dove which I subjected to observation was for a long time fed only with millet; it was put into a cage whose bottom, covered with a plate of glass, admitted of all the excrements being collected without any loss. The millet given as nourishment, was contained in rather a deep porcelain vessel, of a conical form, the small base of the cone constituting the mouth of the vessel; by means of this arrangement, the dove did not let fall in the cage a single grain of millet.

From the commencement of the experiments, the millet intended to be used as food was kept in a sealed flask, in order that throughout their duration, the proportion of moisture which it contained might remain always the same. Every day, at the same hour, a certain quantity of grain was weighed, which was put into the feeding vessel, after having removed and weighed that which remained of the previous ration. The quantity of millet consumed in 24 hours was thus accurately known: and although it was thus discretional, the dove fed itself with sufficient regularity.

The excrements were collected daily at the time when the ration of millet was given; they constantly presented the same appearance, the same spheroïdal form, and their consistence enabled them to be collected with facility; at the end of an experiment, there was detached from the glass plate, which covered the bottom of the cage, the few portions of matter adhering to it. The excrements rendered, in the twenty-four hours, were first weighed while moist; immediately after being weighed, they were dried in an oven, heated to 104° or 122° F. They were dried at this low temperature, from the fear, probably exaggerated, of dissipating some volatile nitrogenous principles. The temperature of the room never exceeded 50° or 52° F.; so that the evacuations, before being placed in the stove, were found free of all fermentation, which might have given rise to ammoniacal vapors.

The experiments were divided into two series: the first comprises five days of observation, the second seven days.

FIVE DAYS OF OBSERVATION.
In Twenty-four Hours.

Dates.	Millet Consumed.	Humid Excrements Colltd.	Weight of the Dove.
	gr.	gr.	gr.
1st day	15·45	7·19	187·90
2nd ,,	15·53	7·11	..
3rd ,,	16·94	8·04	..
4th ,,	14·54	7·54	..
5th ,,	14·17	7·52	186·27
In 5 days	76·64	37·30	

ANALYSIS OF THE MILLET CONSUMED IN TWENTY-FOUR HOURS.

Desiccation.—1 gr. ·871 lost, at temperature of 130° to 135° C., after remaining in the dry vacuum, 0 gr. ·263 of water; water per cent. = 14·0.

The 76 gr. ·74 eaten by the dove in this first series, contained really 65 gr. ·91 of dry millet ashes.

NITROGEN.

Normal millet.	Dry millet.	Nitrogen.	Temperature.
1. 0·775	0·06665	17cc.·8	11° ·0
2. 0·7795	0·6704	19cc.·1	13° ·5

Barometer at 0°.	Nitrogen in weight.	Nitrogen in 100 of dry millet.	
1. 0 m. ·7693	0·02134	3·20	3·30
2. 0 m. ·7642	0·02282	3·40	

CARBON AND HYDROGEN.

Normal millet.	Dry millet.	Water contained.	Carbonic acid.
gr.	gr.	gr.	gr.
1. 0·567	0·4876	0·0794	0·822
2. 0·636	0·5470	0·0890	0·930

Water estimated.	In one hundred of dry millet.	
	Carbon.	Hydrogen.
gr.		
1. 0·357	45·97	6·29
2. 0·399	46·17	6·30
Mean....	46·07	6·295

COMPOSITION OF MILLET CONSUMED IN THE DRY STATE.

Carbon	46·07
Hydrogen	6·29
Nitrogen	3·30
Oxygen	41·76
Saline matters ..	2·58
	100·00

ANALYSIS OF THE EXCREMENTS.

1st Desiccation.—The 87gr.·10 of humid excrements weighed on leaving the oven 16gr.·220. The dry matter was bruised, introduced into a flask, and intimately mixed; in this state it was analysed.

2nd Desiccation.—2gr.·257 of the foregoing powder, after a prolonged desiccation in a dry vacuum, and at the temperature of 130 to 135°, were reduced to 2gr.·093, equal to water 0gr.·164 per cent. 7·27. The 37gr.·30 of humid excrements consequently represent 15gr.·04 of completely dried excrements.

Ashes.—1 gr.·445 of matter dried in the oven, corresponding to 1gr.·3365 of entirely dry excrements, left 0gr.·158 of very white ashes; when powerfully calcined, ashes 11·80 per cent. of dry excrements.

NITROGEN.

0gr.·4775 of matter dried in the oven =0gr.·4428 of dry matter gave—

Nitrogen, 34c.c.·1; temperature, 76·92 equal, nitrogen in weight 0gr. ·04092.

Nitrogen, per cent., in the excrements dried in the oven 8·57; in the excrements dried at 135°, 9·24.

CARBON AND HYDROGEN.

	Matter dried in the air	Carbonic Acid.	Estimated Water.
	gr.	gr.	gr.
1.	0·605	0·812	0·292
2.	0·600	0·812	0·810
	1·205	1·524	0·264
Moisture contained	0·088		0·088
Dried excrements	1·117	Water estimating hydrogen	0·514

This gives for the composition of the dried excrements:—

Carbon	39·65
Hydrogen	5·11
Nitrogen	9·24
Oxygen	34·20
Saline matters.....	11·80
	100·00

(*To be concluded in our next.*)

ON THE QUANTITY OF ATMOSPHERIC AIR NECESSARY FOR THE COMPLETE COMBUSTION OF COAL.*

BY MR. A. MURRAY.

THE practical recommendations given were, that the supply of air should be as free as possible; the entrance into the ashpit should not be less than one-fourth part of the area of the fire-grate; the depth of the ashpit should be about two feet and a half, no advantage being found to result from its being deeper: the space between the fire-bars should be 7-16th inch, but that depth should be regulated by the kind of coal used; for any kind of coal it should not be less than 3-8th inch, nor more than half-inch; the fire-bars were recommended to be made as thin as was consistent with their required strength; half an inch in width had been found to be a good proportion. The space in the furnace above the fire-bars was recommended to be made large, about three cubic feet to each superficial foot of fire-grate, when such an amount could be obtained. The proper area of the flue was next considered with reference to the bulk of the products of combustion and their velocity, showing that the area requisite for the quantity chemically required was found to be much too small, and that in practice it should not be less than two square inches for the products of combustion from each pound of coal consumed in the grate per hour. Taking a furnace in which thirteen pounds of coal were burned on each square foot of fire-grate per hour (which was stated to be a usual rate of combustion in steam-boilers), the area of the flue to every superficial foot of the grate would be twenty-six square inches. The area of the chimney was recommended to be three-fourths of that of the flue. The mode of conducting the flue to the chimney, and the angles formed in its passage, were also considered. The time occupied by the gases in passing through the flues of a boiler, from the instant of their generation to that of their reaching the chimney, was shown not to be of importance, provided that the incalescent gases were to be subdivided, that all the particles were brought into contact with the boiler, and were made to part with their caloric, as was the object in the construction of locomotive and other tubular boilers. The amount of heating surface recommended was in the proportion of eighteen square feet to each foot of fire-grate where the combustion was carried

* Read before the Institute of Civil Engineers, June 11, 1844.—*Athenæum.*

on at the rate of 13 lb. per square foot per hour, though a larger amount might be employed in land-boilers, where there was no objection against cooling down the products of combustion in a greater degree. The principles were stated to be applicable to all kinds of boiler, used either for land or for marine purposes.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

ON THE COMPARATIVE MEDICINAL EFFECTS OF THE SALTS OF IRON.*

BY ROBERT H. POWELL, M.B.

THE *Lancet* for August 10, 1844, contains the following article on the salts of iron, which we have thought might interest our readers at a time when the salts of iron are especially under professional consideration :—

"On reflecting upon the various salts of iron in common use, it appeared to me that practitioners in medicine for the most part select for administration those preparations of iron containing a maximum of oxygen, forming salts of peroxide.

"Now I think it will be found, on careful observation, that the preparations of this metal, in a lower state of oxidation, are more suitable for those cases in which iron is most beneficial, and peculiarly indicated.

"If your valuable space permits, I shall take a cursory review of the principal ones.

"The tincture of the sesquichloride of iron, as is well known, contains a persalt of this metal, and though a very useful preparation as an astringent and tonic, proves often too irritating to the mucous membrane of weakly anemic subjects; it may be observed that there exists a small quantity of a protosalt in solution, which it derives from the same existing in the sesquioxide from which this tincture is formed, which probably imparts some of its efficacy to it.

"The same remarks apply with regard to the sesquioxide of the London Pharmacopœia, which, according to my experience, disagrees with most persons using it, its bulk appearing to oppress the enfeebled stomach; and its beneficial effects being very slowly evinced, which again may arise from the small quantity of protoxide prevented from further oxidation by the sesquioxide, during the precipitation, mechanically enclosing a small amount of the protocarbonate unchanged.

"The tartrate of iron, of the London Pharmacopœia, again, contains this metal in the state of a persalt, though occasionally prescribed, it is not, according to my experience, found a preparation possessing much tonic properties; that prepared by a process followed in Dublin contains a mixture of proto and pertartrate of iron, and will be found a more energetic tonic than the former.

"The aromatic mixture of iron, still in occasional use, again, contains chiefly salts of the peroxide (the tannate and gallate) with small quantities of proto salts, and possesses very questionable medicinal effects; those, probably, arising from the salts of cinchonine and quinine, together with the aromatic ingredients entering into its composition.

"The sulphate of iron, another preparation in daily use, though not a pure protosalt of iron, will be found to possess very active tonic properties, which apparently seem to augment in the ratio of the quantity of metal present in the state of protoxide; the bluish green acid, crystals containing the greatest amount; the pale green, neutral ones, being probably composed of a mixed oxide, combined with sulphuric acid; this preparation, likewise, as is well known, often disagrees with the digestive organs of many.

"The iodide of iron, as usually obtained from manufacturing druggists, is far from being a pure protoiodide, containing much peroxide, free iodine, mixed with a variable amount of protosalt.

"Mr. Donovan, of Dublin, has recommended a process, published in the *Dublin Medical Press*, which insures an almost genuine protoiodide.

"The acetate tincture of iron, much used on the other side of the channel, when properly prepared (which is a matter of much difficulty), will be found a most useful therapeutic agent, well agreeing with most persons requiring the use of this metal.

"From some researches of Dr. Aldridge, of Dublin, published in the *Dublin Journal*, some years past, it would appear that this preparation contains a protoacetate of iron in combination with acetate of potass, which, from galvanic action prevents the iron from passing into a higher state of oxidation, by its electro-positive condition.

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* *The Lancet*, August 10, 1844.

"The green carbonate of iron, as found in the mistura ferri comp., contains a notable quantity of a protosalt; its very general efficacy need scarcely be adverted to. I may here notice the carbonate of iron with sugar, which seems to have the remarkable property of preventing further oxidation, it is, I believe, an efficacious tonic.

"And lastly, iron, as found in chalybeate waters, notwithstanding the inconvenient bulk of the menstruum, in the state of pure protoxide in combination with carbonic acid, is very generally allowed to be the most effectual ferruginous agent.

"On reviewing these several preparations, it will be apparent that their efficacy would seem to be in the ratio of the protosalt present in each.

"What exact part iron plays in the process of sanguification remains to be discovered (it is to be hoped that this abstruse physiological question will, ere long, admit of elucidation, through the strides making in organic chemistry by the renowned Liebig, and other continental chemists), but the fact is certain, that the red particles of the blood are increased in a very apparent manner, and most probably this action, if not absolutely necessary, is facilitated by the metal being in a state of minimum oxidation.

"I have not noticed, in the above short review, the citrates, their chemical and therapeutic properties not having been yet sufficiently tested by the profession."

"Tunbridge Wells."

ON THE USE OF ALKALIES IN CONSUMPTION.*

BY J. S. CAMPBELL, M.D.

In the year 1841 I published a work on the subject of tuberculous consumption, which *The Lancet* reviewed with some degree of favor in the nineteenth number of that journal for 1841-2.

I therein took occasion to enter on a good many points connected with the pathology, as well as the treatment of that formidable disease, but one of my leading objects was to express a strong belief in the value of an alkaline treatment, when *perseveringly employed*. Since that period I have not published a line on the subject, though both my own additional experience and the reports I have received from others have gone far to confirm my former convictions.

In conformity with the usual practice, I then thought it proper to illustrate my views by recording some cases, taken from many others I might have printed; but I feel so perfectly convinced that no plan of treatment in this disease ought to be received with any confidence, unless a certain amount of *permanence* can be connected with presumed benefit, that up to this period, as already named, I have entirely abstained. On these grounds you will oblige me by inserting this letter, chiefly intended to show how the cases, originally reported nearly three years ago, now remain.

They were then arranged under three heads.

The first head contained eleven, presumed to be fair examples of phthisis in its early stages. The sympathetic as well as physical evidence on which I rested was there given.

The second contained three only, my object being to *hint* at the *possibility* of tubercular absorption, while the adventitious deposit was as yet unsoftened.

And the third contained three cases of consumption in its very advanced stages, and were reported only to show how, at times, very unexpected results arise, even late in this intractable malady. Against any imputation of absurd assumption, I thought I had pretty well guarded myself by the few lines which succeeded the report of those three cases; but as it apparently suits certain parties in our profession to be inspired with a holy horror of the man who thinks that medicine, beyond the mere treatment of symptoms, can be of the least use in consumption, you will much oblige me by here appending, as a note, the paragraph I refer to.*

Of the eleven cases reported under the first head, *one* died in October, 1842. Three of them I have been unable for a long time to trace. The remaining seven are alive, and comparatively well, subject only to the occasional inconveniences which result, and ever must result, from a condition of lung,

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* *The Lancet*, August 10, 1844.

* "In reporting this and the two preceding cases, I could desire most emphatically to disclaim any wish to have them considered as examples of what usually occurs when an alkaline treatment is persevered in; or of what indeed occurs under any treatment whatsoever; so far from this, these three cases are by far the most marked examples of benefit I have seen from treatment, when this was commenced after the second, or reactive stage of phthisis had been fully established; but even these few may, if properly viewed, hold out to us a useful lesson, and direct our attention to a remedy, of whose efficacy, when employed early, I cannot entertain any doubt whatever."—(Campbell on Tuberculous Consumption, p. 400.)

partially impaired, and always prone to disease.

In the majority of these seven, the physical state of the lung appears to remain stationary. The advantage gained has seemingly arisen from the non-extension of disease. One exception to this alone occurs in the case of *Mary Lucas*. The physical signs before reported are in character the same, but so far as the ear can contrast sounds at such a distance of time, they are less marked, and the inference from them less decided. At all events, she is robust and well. The last time I saw her was three weeks ago; she then applied, in consequence of a slight but acute "cold," from which very simple treatment speedily freed her.

Of three cases, contained in the second class, I can give an account of two only. The first, named Bull, was a gentleman's servant, and consequently of migratory habits; I have not heard of him for two years. The second and third (Stanley and Vivers), are alive, and in the enjoyment, the one of good, the other of tolerable, health. Stanley was a young girl, who has since gone to service, and though still slender in form, and sallow in complexion, fulfils somewhat laborious duties without discomfort, and is free from pectoral symptoms. The second of the two (Vivers) is a highly nervous person, and liable to occasional attacks of hysteria, but presents no symptoms of pulmonic disease. In neither instance do the physical signs essentially vary now from those originally given.

It would appear, therefore, that of fourteen cases which I reported nearly three years ago, and described as fair average examples of *phthisis in its early stages*, one only is known to be dead, nine known to be living, and four whose fate is entirely unknown. Since then I have treated about four hundred more of the same kind, on the same principles, but must, at present, be content to say, simply that results have, in my own belief, been highly satisfactory.

I need scarce add, that one and all of the cases named have been *essentially* treated by the *caustic alkali*, superadding, as far as circumstances permitted, a close attention to the various points of accessory practice, which I before attempted to lay in detail before the profession. In the majority of examples there might be recommended—without much hope of execution—pure air, light but nutritious diet, proper clothing, and, equal to all, perhaps, a due regulation of stimulants, both in quality and quantity; but these are, one and all, often by necessity, frequently by prejudice or habit, denied to the poor. In the small minority of examples, I have more or less been enabled, from the patient's position in life, and a due confidence in myself, to carry *all* my views into execution, and may fairly say, that just as the means and will of so doing existed in the patient, so has been the comparative success or failure of the attempt.

I write, Sir, with a sincere hope of impressing the members of our profession generally, with such an amount of confidence as may induce them to *test* the validity of the principles recommended. That they will, like myself, be often disappointed, is undoubtedly true, but that they will often succeed, I feel equally convinced of, and that to an extent greater than by the use of any other means at present known. But let me beg of them to draw the line between a merely fanciful success, founded on the alternation of symptoms, and those more permanent benefits which spring from a *limitation of the local malady*, in which, to a large extent, such symptoms originate.

I for the time conclude, not wishing to burden your columns, although the subject be one of deep interest, and one on which I have yet much more to say.

Weymouth-street, Portland-place,
June 3, 1844.

ON THE EXTRACT OF HENBANE.

To the Editors of The Chemist.

My Dear Sirs,

The extract of henbane, P.L. having attracted attention, I send you the result of an experiment made in the year 1838:—

My opinion relative to the impotency of "green extracts" has already appeared in The Chemist, and is in perfect accordance with remarks which have lately appeared, that the chlorophylle and albumen are inactive.

The quantity of henbane experimented upon was sixty-two hundred weight. The chlorophylle and albumen, when reduced to an extract, yielded, by weight, rather more than one-half of the entire product. The color of this extract was a lively pea green; became mouldy after an interval of a few days; perfectly inert as a medicine.

The remaining fluid reduced to an extract yielded, by weight, scarcely one half of the entire product. Color dark brown. This extract possesses all the potency of the henbane; does not become mouldy; in fact, is unchangeable.

Samples of each were sent to my friend, Dr. Dillon (whose letter I enclose), requesting his opinion upon the efficacy of each.

His practice led him to the conclusion at which I had arrived, namely, that more than one half of the extract of henbane P.L. is inactive, and should be rejected.

Numbers 1 and 2, noticed in Dr. Dillon's letter, were chlorophylle and albumen.

Number 3. Extract free from chlorophylle and albumen.

Number 4. The whole combined, *i.e.*, the extract P.L.

Believe me,
My dear sirs,
Yours most truly,
G. WHIPPLE.

London, August 5, 1844.

"SIR—According to your desire I have tried the efficacy of the four kinds of extracts of hyoscyamus which you sent me. Nos. 1 and 2 I cannot depend upon; No. 3 has not failed in one instance in producing the desired effect. No. 4 appears to be very good, but I have not found it to be so efficacious as No. 3, which I can strongly recommend when the use of that drug is required.

"I remain, Sir,
"Your obedient servant,
"EDWARD C. DILLON, M.D.

"High-street, Islington, Sept. 10, 1838.
"Mr. Whipple."

A BILL FOR THE BETTER REGULATION OF MEDICAL PRACTICE THROUGHOUT THE UNITED KINGDOM.*

WE take the earliest opportunity of laying before our readers the Bill introduced into Parliament by Sir James Graham, and at the same time would urge upon all interested in such a measure the most careful and attentive consideration of it.

The Profession has nearly six months for discussing the provisions of this Act, an opportunity which will, we hope, be turned to account.

The Act leaves untouched the question respecting Chemists; but there is no doubt that the opposition which will be offered on the part of medical practitioners will be successful in preventing it from becoming law. We confess our disappointment at the nature of the Bill, and sincerely hope that it will be successfully opposed.

PREAMBLE.—I. REPEAL OF STATUTES.

3 Hen. 8, c. 11. 5 Hen. 8, c. 6. 14 & 15 Hen. 8, c. 5. 32 Hen. 8, c. 40. 32 Hen. 8, c. 42. 34 & 35 Hen. 8, c. 8. 1 Mary, Sess. 2, c. 9. 6 & 7 W. 3, c. 4. 10 Geo. 1, c. 20. 18 Geo. 2, c. 15. 55 Geo. 3, c. 194. 6 Geo. 4, c. 50, s. 2.

"WHEREAS it is for the good of all Her Majesty's subjects that the knowledge of Physic and Surgery should be promoted, and that means should be afforded whereby those who have been examined and found skilful by competent authority may be known from ignorant and unskilful pretenders to the same knowledge: And whereas the laws now in force concerning the Profession of Physic and Surgery require to be amended; Be it Enacted by the Queen's most Excellent Majesty, by and with the Advice and Consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the Authority of the same, That an Act passed in the third year of the reign of King Henry the Eighth, intituled, "An Act for the appointing of Physicians and Surgeons;" and also another Act passed in the fifth year of the same reign, intituled, "An Act concerning Surgeons to be discharged of Quests and other Things;" and also another Act passed in the Session of Parliament holden in the fourteenth and fifteenth years of the same reign, intituled, "The Privileges and Authority of Physicians in London;" and also two Acts passed in the thirty-second year of the same reign, respectively intituled, "For Physicians and their Privilege," and "For Barbers and Surgeons;" and also another Act passed in the Session of Parliament holden in the thirty-third and thirty-fourth years of the same reign, intituled, "A Bill that Persons being no common Surgeons may minister Medicines, notwithstanding the Statute;" and another Act passed in the first year of the reign of Queen Mary, intituled, "An Act touching the Corporation of Physicians in London;" and also an Act passed in the Session of Parliament holden in the sixth and seventh years of the reign of King William the Third, intituled, "An Act for exempting Apothecaries from serving the Offices of Constable, Scavenger, and other Parish and Ward Offices, and from serving on Juries;" and so much of every other Act as continues the last-recited Act; and also an Act passed in the tenth year of the reign of King George the First, intituled, "An Act for the better viewing, searching, and examining of all Drugs, Medicines, Waters,

* The words printed in *italics* are proposed to be inserted in the Committee.

Oils, Compositions, used or to be used for Medicines, in all places where the same shall be exposed for Sale, or kept for that purpose, within the City of London and Suburbs thereof, or within Seven Miles circuit of the said City;" and so much of another Act passed in the eighteenth year of the reign of King George the Second, intituled, "An Act for making the Surgeons of London and the Barbers of London two separate and distinct Corporations," as does not relate to the separation of the said Corporations, or to the Master, Governors, and Commonalty of the Mystery of Barbers of London; and also so much of an Act passed in the fifty-fifth year of the reign of King George the Third, intituled, "An Act for better regulating the Practice of Apothecaries throughout England and Wales," as relates to the examination of Apothecaries, or to the qualifications of persons intending to be examined or to qualify themselves under that Act to practise as an Apothecary, or to the fees to be paid by Apothecaries for the Certificate of the Court of Examiners, or to the penalties for practising as an Apothecary without having obtained such Certificate; and also so much of an Act passed in the sixth year of the reign of King George the Fourth, as enacts, that all Members and Licentiates of the Royal College of Physicians in London actually practising; all Surgeons being Members of the Royal Colleges of Surgeons in London, Edinburgh, or Dublin, and actually practising; all Apothecaries certified by the Court of Examiners of the Apothecaries' Company, and actually practising, shall be free and exempt from being returned, and from serving upon any Juries or Inquests whatsoever, and shall not be inserted in the lists to be prepared by virtue of that Act; and also so much of any Act or Charter granted before the *passing of this Act* as prohibits any person from practising Physic or Surgery in any place without such license as is mentioned in such Act or Charter respectively, or as imposes any restriction on the practice of Physic or Surgery other than is contained in this Act, shall be repealed and annulled.

II. COUNCIL OF HEALTH AND MEDICAL EDUCATION.

And be it Enacted, That a Council shall be established, which shall be styled "The Council of Health and Medical Education;" and that One of Her Majesty's Principal Secretaries of State shall be a Member of the said Council, in right of his office as Secretary of State; and that the Regius Professor of Medicine in the University of Oxford, the Regius Professor of Physic in the University of Cambridge, the Regius Professor of Physic in the University of Dublin, the Regius Professor of Clinical Surgery in the University of Edinburgh, and the Regius Professor of Surgery in the University of Glasgow, shall be Members of the said Council in right of their several Professorships; and that the other Members of the said Council shall be *One* Physician and *One* Surgeon, to be chosen by the Colleges of Physicians and Surgeons of England respectively; *One* Physician and *One* Surgeon to be chosen by the Colleges of Physicians and Surgeons of Scotland respectively; *One* Physician and *One* Surgeon to be chosen by the Colleges of Physicians and Surgeons of Ireland respectively; and *Six* other persons whom Her Majesty, with the advice of Her Privy Council, shall deem fit to be Members of the said Council.

III. APPOINTMENT OF FIRST COUNCIL.

Provided always, and be it Enacted, That it shall be lawful for Her Majesty, with the advice of Her Privy Council, to appoint all the Members of the first Council of Health and Medical Education, other than those who will be members thereof in right of their several offices; and that at the end of the *Third* and each of the *Two* next following years after the first constitution of the said Council, *One* Physician and *One* Surgeon of those first appointed on behalf of the said several Colleges of Physicians and Surgeons, shall go out of office, in such order as Her Majesty, with the advice of Her Privy Council, shall direct.

IV. TENURE OF OFFICE BY OFFICIAL MEMBERS AND NOMINEES OF THE CROWN.

And be it Enacted, That those Members of the said Council who are Members in right of their several offices shall continue to be Members thereof so long as they hold the same offices respectively, and no longer, and the *Six* Members of the said Council, appointed as aforesaid by Her Majesty, with the advice of Her Privy Council, shall continue to be Members of the said Council during Her Majesty's pleasure, and upon every vacancy among the last-mentioned Members of the said Council, and their successors, it shall be lawful for Her Majesty, with the advice of Her Privy Council, to appoint another fit person to be a Member of the said Council during Her Majesty's pleasure.

V. TENURE OF OFFICE BY MEMBERS CHOSEN BY THE COLLEGES.

And be it Enacted, That upon every

vacancy among the Members of the said Council appointed on behalf of the said several Colleges of Physicians or Surgeons, and their successors, the Royal College of Physicians or Surgeons of England, Scotland, or Ireland, as the case may be, shall appoint another Physician or Surgeon, as the case may be, to supply such vacancy, subject to the approval of Her Majesty; and every Member of the Council so chosen shall be entitled to be a Member of the said Council for *Three* Years, and shall then go out of office, but may forthwith be re-chosen, subject to Her Majesty's approval: Provided always, That no President, Vice-President, or Examiner of any of the said Colleges shall be qualified to be so appointed.

VI. DETAILS OF ELECTION TO BE SETTLED BY THE SEVERAL COLLEGES.

And be it Enacted, That the manner of choosing the last-mentioned Members of the said Council shall be determined in each case by orders or bye-laws to be made from time to time by the said several Colleges, subject to the approval of the Council of Health and Medical Education.

VII. SUBSTITUTES IN CASES OF EXTRAORDINARY VACANCIES.

Provided always, and be it Enacted, That it shall be lawful for any Member of the said Council appointed by Her Majesty, or chosen by any of the said Colleges, at any time to resign his office, or for Her Majesty at any time, with the advice of Her Privy Council, to dismiss any such Member of the said Council for notorious misbehaviour or unfitness, and upon any vacancy in the said Council by death, resignation or dismissal, another Member of the Council shall be appointed in the same manner and for the same term as the Member by whom the vacancy shall have been made.

VIII. SECRETARIES, CLERKS, AND MESSENGERS.

And be it Enacted, That it shall be lawful for the said Council, with the approval of One of Her Majesty's Principal Secretaries of State, to appoint a Principal Secretary for the said Council, and also Local Secretaries for Scotland and Ireland, and so many Clerks and Messengers, as the said Secretary of State shall deem necessary, and also with the like approval to remove at their pleasure any of the said Secretaries, Clerks, and Messengers, and appoint others in their room.

IX. SALARIES AND EXPENSES.

And be it Enacted, That there shall be paid to the Members of the said Council, and to the said Secretaries, Clerks, and Messengers, such Salaries as shall be from time to time allowed by the Lord High Treasurer or Commissioners of Her Majesty's Treasury, who may also allow such reasonable travelling expenses which may have been incurred by any Member of the said Council, or any Secretary, Clerk, or Messenger in the performance of his duties under this Act, and such other reasonable expenses of putting this Act into execution, as the said Lord High Treasurer or Commissioners of Her Majesty's Treasury shall think fit.

X. PRESIDENT.

And be it Enacted, That the said Secretary of State shall be President of the said Council, and shall be empowered from time to time to nominate one of the Members of the Council appointed as aforesaid by Her Majesty to be Vice-President of the Council, and to act as President in his absence, and at every meeting of the Council in the absence of the President and Vice-President, some other Member, to be chosen by the Council from the Members then present, shall be empowered to act as President.

XI. TIME AND PLACE OF MEETING.

And be it Enacted, That the said Council shall be holden in such places and at such times as the Secretary of State from time to time shall appoint; and that all acts of the Council shall be decided by the votes of the majority of the Members present at any meeting, the whole number not being less than *Seven*; and at all such meetings the President for the time being shall have a second or casting vote in all cases of equality of votes.

XII. MINUTES OF PROCEEDINGS.

And be it Enacted, That minutes of the proceedings at all meetings of the Council shall be drawn up and fairly entered in books to be kept for that purpose; and such minutes shall be at all reasonable times open to the inspection of any person or committee appointed for the purpose of inspecting them by any of the said Universities or Colleges.

XIII. REGISTER TO BE KEPT AND PUBLISHED.

And be it Enacted, That a Register shall be kept and published from time to time, under the direction of the said Council, of all persons who shall have been examined, and shall have received, and shall exhibit before the said Council Letters Testimonial as hereinafter mentioned of their qualification to practise as a Physician, or as a Surgeon, or as a Licentiate in Medicine and Surgery; for which registry the Council shall be entitled to have from the person requiring to

be registered a fee of *Five Pounds* in the case of a Physician or Surgeon, and a fee of *Two Pounds* in the case of a Licentiate, which fees shall be employed toward defraying the expenses of this Act; and ever person whose name shall be so registered, who shall be desirous that his name shall be continued in the published Register, shall in the month of *January* in every year send to the said Council his name and place of abode, with the date of his Testimonials, and the Council shall verify the returns so made to them by comparison with the Register kept by them, and shall forthwith cause the names of all persons duly registered, and so returned to them, to be published in alphabetical order in their several classes, with their several places of abode, and dates of their Testimonials.

XIV. LICENTIATES IN MEDICINE AND SURGERY.

And be it Enacted, That no person, except such Graduates in Medicine and such other legal practitioners as are hereinafter mentioned, shall be entitled to be registered by the Council as a Licentiate in Medicine and Surgery unless he shall have attained the age of *Twenty-one* years, and shall have been examined by the Colleges hereinafter named; (that is to say) if in England, examined by the Royal College of Physicians of England, assisted by the Court of Examiners of the Apothecaries' Company, and also examined by the Royal College of Surgeons of England; and if in Scotland, examined by the Royal Colleges of Physicians and Surgeons of Scotland; and if in Ireland, examined by the Royal Colleges of Physicians and Surgeons in Ireland; and in every case shall have received Letters Testimonial from each of the bodies by which he shall have been examined, of his being duly qualified to practise as such Licentiate.

XV. SURGEONS.

And be it Enacted, That no person, except such legal practitioners as are hereinafter mentioned, shall be entitled to be registered by the Council as a Surgeon unless he shall have attained the age of *Twenty-five* Years, and shall have been examined by One of the Royal Colleges of Surgeons of England, Scotland, or Ireland, or the Royal College of Physicians and Surgeons of Glasgow, after such proof as shall be satisfactory to the Examining College that he has applied himself to surgical studies during at least *Five* Years; and shall have received Letters Testimonial from the examining College of his being duly qualified to practise as a Surgeon.

XVI. PHYSICIANS.

And be it Enacted, That no person, except such legal practitioners as are hereafter mentioned, shall be entitled to be registered by the Council as a Physician unless he shall have attained the age of *Twenty-six* Years, and shall have graduated in Medicine in some University of the United Kingdom of Great Britain and Ireland, or, subject to the restriction hereinafter contained, in some foreign University, and shall also have been examined by one of the Royal Colleges of Physicians of England, Scotland, or Ireland, or by the Royal College of Physicians and Surgeons of Glasgow, after such proof as shall be satisfactory to the Examining College that he has applied himself to medical studies during at least *Five* Years, or if he is not a Graduate in Medicine of any such University, unless he shall have attained the age of *Forty* Years, and shall have been examined by the Royal College of Physicians of England; and in each case shall have received Letters Testimonial from the Examining College of his being duly qualified to practise as a Physician; and no person shall be entitled to be received for examination for the purpose of being so registered as a Physician upon a foreign Degree in Medicine, unless the Royal College of Physicians of England, Scotland, or Ireland shall give him a special certificate, to be laid before and approved by the Council of Health and Medical Education, that they have made inquiry into the manner in which such degree was conferred, and have ascertained that it has been granted after residence within the precincts of the same University during at least *One Year*, and after due examination and upon satisfactory certificates of previous study.

XVII. PHYSICIANS AND SURGEONS MAY BE REGISTERED ON DOUBLE TESTIMONIALS.

And be it Enacted, That it shall be lawful for the same person, if possessed of the necessary Testimonials, to be registered as both Physician and Surgeon, and for a registered Physician, or a person applying to be registered as a Physician, to offer himself for examination as a Licentiate in Surgery by one of the said Royal Colleges of Surgeons, and for a registered Surgeon, or a person applying to be registered as a Surgeon, to offer himself for examination as a Licentiate in Medicine by one of the said Royal Colleges of Physicians, assisted in England by the Court of Examiners of the Apothecaries' Company; and every such Physician or Surgeon shall be entitled to be also registered upon the Testimonials granted to him upon such additional Examination, in such form and manner as shall be determined by the said Council.

XVIII. PHYSICIANS AND SURGEONS TO BELONG TO A ROYAL COLLEGE OF THE COUNTRY IN WHICH THEY PRACTISE.

And be it Enacted, That every person registered after examination as a Physician or Surgeon under this Act, shall be admitted as an Associate of the Royal College of Physicians, or as a Fellow of the Royal College of Surgeons from which he shall have received his Letters Testimonial as Physician or Surgeon, or if he shall have received the said Testimonials from the Royal College of Physicians and Surgeons of Glasgow, then as a Fellow of the last-mentioned Royal College; and every such Physician and Surgeon who shall afterwards remove from that part of the United Kingdom in which he obtained his Letters Testimonial, shall be required, if he shall practice as a Physician or Surgeon in any other part of the said United Kingdom, to enroll himself as an Associate of the Royal College of Physicians, or as a Fellow of the Royal College of Surgeons, of that part of the United Kingdom to which he shall so remove, for the purpose of practising there, according to the nature of his Testimonials, and in each case shall be entitled to be so admitted without further examination, and on payment of the like fees of admission, and on complying with the same conditions as are required of other persons who have passed their examinations for the purpose of being admitted Associates or Fellows of the said Colleges respectively.

XIX. QUALIFICATIONS AND FEES.

And be it Enacted, That the said several Colleges shall, from time to time, when required by the said Council, prepare and lay before the said Council a scheme or schemes of the course of study and particulars of the examination to be gone through by all persons applying to such Colleges respectively for Letters Testimonial as Physician, or Surgeon, or Licentiate, and of the Fees to be taken for examination and admission into the said several Colleges respectively; and the said Council shall be empowered to make from time to time such changes in any of the schemes so laid before them as to the said Council shall seem expedient; and the said Council shall endeavor to procure, as far as is practicable and convenient, that the Qualifications and Fees for the said Testimonials shall be uniform, according to the nature thereof throughout the said United Kingdom.

XX. RESTRICTION ON MEDICAL DEGREES.

And it be Enacted, That after the *passing of this Act* it shall not be lawful for any University of the said United Kingdom to confer any degree in the Faculty of Medicine upon any person, unless he shall have been matriculated in the same University, and shall have duly attended the courses of public Lectures prescribed by the same University to Students in Medicine within the precincts of the same University, or of some Medical School recognised by and in connexion with the same University, during at least *Two* Years next before the granting of such Degree, and shall have been examined at some time before granting such Degree by the proper Examiners of such University, and found by them to possess competent skill and knowledge of Medicine, and of the sciences connected therewith, and of the English and Latin languages at least; and every Diploma or Certificate of a Medical Degree granted by any such University after the *passing of this Act*, shall set forth distinctly the time which has elapsed since the matriculation of the person to whom such degree shall be granted, and the time during which, and place at which he shall have actually studied as aforesaid, and the fact that he has passed such examination as last aforesaid.

XXI. DECLARATION CONCERNING BACHELORS OF MEDICINE AT THE AGE OF TWENTY-TWO.

And be it Declared and Enacted, That it shall be lawful for any University of the said United Kingdom to grant the Degree of Bachelor in the Faculty of Medicine, subject to the restrictions hereinbefore contained concerning Medical Degrees, to any Student of the same University who shall have attained the age of *Twenty-two* Years; and that every such Graduate in the Faculty of Medicine, being also examined and having received Letters Testimonial of his qualification in the manner hereinbefore prescribed in the case of Licentiates in Medicine and Surgery, or examined and furnished with the like Letters Testimonial by the Royal College of Physicians and Surgeons of Glasgow, if the said degree shall have been granted by the University of Glasgow, shall be entitled to be registered by the said Council of Health and Medical Education as a Licentiate in Medicine and Surgery, subject to such general regulations as shall be made by the said Council concerning the registry of Licentiates.

XXII. RESTRICTION ON BYE-LAWS.

And be it Enacted, That no bye-law to be made by any of the Royal Colleges of Physicians or Surgeons of England, Scotland, or Ireland respectively, or by the Royal College of Physicians and Surgeons of Glasgow, shall be of any force until a copy thereof, sealed with the seal of the same College, shall have been laid before and approved by the said Council of Health and Medical Education.

XXIII. REGISTRY OF STUDENTS.

And be it Enacted, That it shall be lawful for the said Council to make regulations for ensuring the registry of all Medical and Surgical Students by the proper officers of the several Hospitals or Medical or Surgical Schools at which they shall study, and to authorise such officers to take a fee for such registration, not being more in each case than *Ten Shillings*, and for requiring all such fees to be remitted to the Secretary of the said Council, and returns to be made to them of the registration of all such Students, in such manner and form as the Council shall think fit; and no Hospital or Medical or Surgical School shall be recognised by any of the said Colleges, which shall neglect or refuse to give due effect to such regulations, after notice of such neglect or refusal shall have been sent by the said Council to the said Colleges, until the default of such Hospital or Medical or Surgical School be amended to the satisfaction of the said Council, and all such fees shall be applied toward the expenses of this Act.

XXIV. CONSTITUTION OF THE EXAMINING BODIES.

And be it Enacted, That where by this Act it is provided that the concurrence of more than one body is required for qualifying any person to be registered by the said Council, the examination before such bodies for his Degree or Letters Testimonial, or both, may be conducted either separately before Examiners appointed by each body, or before a joint Board of Examiners, to be appointed by each body separately or conjointly, who shall be appointed in such number, manner and form, and shall hold their examinations at such times and places as such bodies shall, with the approval of the said Council, agree from time to time among themselves, or as shall be determined by the said Council with respect to any point in which they shall not be agreed; and where there shall be separate examinations before Examiners appointed by each body, the subjects and fees of examination shall be divided among such bodies as they shall from time to time agree among themselves, or as the said Council from time to time shall determine with respect to any subject on which they shall not be agreed.

XXV. FOR SECURING EFFICIENCY OF EXAMINATION.

And be it Enacted, That the said Council may from time to time require returns to be made in such form, and including such particulars, as they shall think fit, respecting the examinations to be conducted as aforesaid, and it shall be lawful for any Secretary of the said Council, deputed by the Council for that purpose, or for any Member of the said Council, to be present at any of the said examinations; and if the Council shall be of opinion that the regulations prescribed by them for the examination and grant of Letters Testimonial as Physician, Surgeon, or Licentiate, have been infringed, evaded or neglected by any of the said examining bodies, it shall be lawful for the said Council to refuse to register upon the Testimonials of the body so in default, until the same be amended to the satisfaction of the said Council.

XXVI. NONE BUT THOSE REGISTERED TO BE APPOINTED TO PUBLIC SITUATIONS.

And be it Enacted, That, subject to the reservations hereinafter contained, no person after the *passing of this Act* who is not registered by the said Council shall be appointed to any medical or surgical office in any public hospital, prison, infirmary, dispensary, workhouse, or other public institution in the said United Kingdom, or to any medical or surgical office in Her Majesty's Army or Navy, or in the service of the Honorable East India Company, except in India, natives of India duly qualified according to such laws or regulations as are or shall be made in that behalf by the Governor-General in Council; and wherever by law it is provided that any act shall be done by a Physician or Surgeon, or Medical or Surgical Practitioner, by whatever name or title he is called, such provision shall be construed, after the *passing of this Act*, to mean a person qualified to be appointed to such medical or surgical offices as aforesaid; and the Council of Health shall be empowered from time to time to make regulations for specifying what institutions are to be considered public institutions within the meaning of this Act, and which form of Testimonial shall be necessary to qualify the holder thereof for every such situation.

XXVII. PRIVILEGES OF PERSONS REGISTERED.

And be it Enacted, That all persons who are registered by the said Council as Physicians, Surgeons or, Licentiates, shall be exempt while practising as such from being summoned or serving on all Juries and Inquests whatsoever, and from serving all corporate, parochial, ward, hundred, and township offices, but, subject to the reservations hereinafter contained, no person shall be entitled to such exemption, on the ground of his practising Medicine or Surgery, who is not so registered, nor shall the Certificate of any such unregistered person, given after the *passing of this Act*, be received as the certi-

ficate of a Medical or Surgical Practitioner in any court of law, or in any case in which by law the Certificate of a Medical or Surgical Practitioner is required.

XXVIII. PERSONS NOW PRACTISING MAY BE REGISTERED.

Provided always, and be it Enacted, That it shall be lawful for the said Council, on the application, within *Twelve* calendar Months after the *passing of this Act*, of any person legally practising as a Physician, Surgeon, or Apothecary, at the time of the *passing of this Act*, in any part of the United Kingdom of Great Britain and Ireland, or on the application within *Two* Years of any person so legally practising in any of Her Majesty's Colonies and Foreign Possessions to cause the name of such person to be registered as a Physician, Surgeon, or Licentiate in Medicine and Surgery, as the case may be, on production to the said Council of his diploma, license, or certificate, or such other proof as shall be satisfactory to the said Council, that at the time of the *passing of this Act* he was legally entitled to practice as a Physician, Surgeon, or Apothecary, as the case may be, in some part of the said United Kingdom, and on payment of a fee of *Two Pounds* in the case of Fellows or Associates of the said Colleges of Physicians and Surgeons respectively, and of *Five Shillings* in every other case, which fees shall be applied toward the expenses of this Act; and during the said period of *Twelve* calendar Months every person legally practising as a Physician, Surgeon, or Apothecary at the time of the *passing of this Act* in the said United Kingdom, and during the said period of *Two* Years, every person so legally practising in any of Her Majesty's Colonies and Foreign Possessions, although not registered, shall continue to enjoy the same privileges and exemptions, and be qualified to be appointed to the same offices, and to practise in the same manner as if this Act had not been passed, and no farther or otherwise, unless registered under this Act.

XXIX. PENALTY ON UNQUALIFIED PERSONS FOR PRACTISING IN PUBLIC OFFICES.

And be it Enacted, That every person appointed after the *passing of this Act* to any Medical or Surgical Office for which he is not qualified according to the provisions of this Act and the regulations of the said Council, and who shall act or practise in such Office, shall for every such offence forfeit the sum of *Twenty Pounds*, to be recovered by action of debt or information to be brought in any of Her Majesty's Courts of Record at Westminster, or in the Court of Exchequer in Scotland, or in Dublin, within *Six calendar Months* next after the commission of the offence, and to be recovered in the name of Her Majesty's Attorney-General in England or Ireland, or of the Lord Advocate in Scotland.

XXX. NONE BUT REGISTERED PERSONS OR THOSE ALREADY PRACTISING MAY RECOVER CHARGES.

And be it Enacted, That after the *passing of this Act*, no person shall be entitled to recover any charge in any court of law for any medical or surgical advice, attendance, or operation, or for any medicine prescribed or administered, unless he shall prove upon the trial either that he is registered under this Act, or that he was legally practising in the capacity in which he claims such charge before the passing of this Act.

XXXI. PENALTY FOR FALSELY PRETENDING TO BE ON THE REGISTER.

And be it Enacted, That every unregistered person who shall wilfully and falsely pretend to be, or take or use any name or title implying that he is registered under this Act, shall be deemed guilty of a Misdemeanor in England and Ireland, and in Scotland of a crime and offence, and being convicted thereof, shall be punished by fine or imprisonment, or both, as the Court before which he shall be convicted shall award.

XXXII. ACT MAY BE AMENDED OR REPEALED.

And be it Enacted, That this Act may be amended or repealed by any Act to be passed in this Session of Parliament.

THE DOINGS AND SAYINGS OF THE PHARMACEUTICAL SOCIETY AND THEIR FRIENDS.

THERE is one hope left for the resuscitation of the Pharmaceutical Society in the fact that they begin to acknowledge the justness and worth of the criticisms which have been written upon their sayings and doings. We take to ourselves no inconsiderable portion of the merit that is due for the improvement that has taken place in the tone of their journal, in consequence of "the mixture of severe criticisms and judicious remarks" which they admit in their last number have been made. But there remains much more to be done—confession is only the stepping-stone to repentance, and repentance to reformation.

The chief object of the Society is, or

ought to be, educational; not in the establishment of lectureships on chemistry or pharmacy, for they already exist in superfluous abundance, but of the means of acquiring knowledge in experimental science. How do they meet this demand? Thus: by permitting the professor of pharmacy to take pupils for instruction in pharmaceutical operations. What a puerile and impotent exhibition of their judgment and means! what a futile application of the time of the teacher and the taught! Instead of instruction in distillation, decantation, desiccation, depuration, and defecation, why not establish a course of practical chemistry? The whole may be learnt in the time occupied in teaching the part. If their present professor is incompetent to the task, let the council engage a person that is adequate, there is no scarcity of scientific chemists in the present day, even in their own body; and we would rather see one of their fellow-members elected to the office than such men as their professors of Chemisty or Materia Medica, who only look on the Pharmaceutical Society for temporary emolument and occupation until they can secure some professorship in the larger institutions or universities. In fact, these gentlemen are ashamed of their connexion with the Society, and will rather be entitled *lecturers* at the Middlesex or London Hospitals than *professors* to the Pharmaceutical Society. Unhappy council! we speak of these things more in sorrow than in anger! Luckless wights, that ye should suffer these indignities, and that Messrs. Pereira and Fownes should prefer the arena of the Royal, Botanical, or Chemical Societies for the display of their scientific researches rather than the Pharmaceutical Society of Great Britain. We will now tell the council how to remedy these grievances, more especially if they wish their members to be something more than the introducers of a French preparation, or the imitators of a Battley's sedative. To what cause, besides their genius, is the celebrity of a Farady, or an Owen, due; or, to come nearer home, a Soubeiran, or a Leeanu? The answer is, to the enjoyment of comparative sinecures in the institutions to which they are attached, which gives them leisure to pursue original investigations, and the means to secure "food and raiment," without being harassed from morning till night in currying favor with the physicians, or competing with their neighbors in the sale of Seidlitz powders or soluble Cayenne. To come to the point, we would advise the council to institute two or more offices in their Society, with liberal salaries, and enjoying an exemption from any duties except those purely scientific; and moreover, to choose persons, qualified by their education and attainments, from amongst the members exclusively, without regard to this man's jealousy, or that man's rancor, to fulfil such offices. The Society has ample funds to carry out these suggestions, which, when adopted, will prove a credit to the body, and an honor to the pharmaceutical science of our country. By so doing, the council will prove that the words pharmacy and twaddle are not synonymous.

W. B.

ON THE MEDICINAL MIXTURES EMPLOYED AS STYPTICS.*

BY DR. GOTTSCHALK.

Dr. Gottschalk thinks that a medicinal mixture can act as a styptic only when it is not applied in the liquid form. "He has demonstrated," he says, "that vegetable astringents do not merit this denomination, that they are not in reality astringents properly so called, because if they tan the tissues they give rise to a chemical combination which is accompanied by a thickening and not by a contraction of those tissues." This experimentalist has made several trials with portions of intestine and pieces of liver which he allowed to remain for five days in solutions of sulphate of copper, sulphate of zinc, sulphate of iron, acetate of lead, crystallised alum, calcined alum, sulphuric acid, hydrochloric acid, nitric acid, and creosote. The results which he obtained in these experiments led him to the following conclusions:—

1st. The strongest styptics, alum, acetate of lead, and sulphate of copper, lose their styptic virtue when they are employed in the liquid form.

2nd. The liquid form is opposed, on the one hand, to the contraction of the tissues; on the other hand, it gives rise to a softening of the animal substance, and, consequently, it facilitates imbibition, impregnation, the thickening, and enlargement of the tissues, and it thus diminishes the tendency to destructibility.

3rd. The acids employed, except nitric acid, do not possess any styptic property; but they possess the property of rendering the tissues thicker.

Dr. Gottschalk, in extending his investigations to the decoctions of oak, rhatany, tormentilla, and nutgalls, in which he steeped for eight days dried pieces of intestine, and for five days pieces of sclerotica, cornea, and conjunctiva of the ox in the

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* *Zeitschrift für die Gesammte Medecin.*

fresh state, arrived at the following conclusions:—

1. None of the astringents indicated merit this name when they are employed under a form which prevents them from removing water from the tissues which are found in contact with them.

2. They are so much the less astringent, as in the liquid form they penetrate deeply into the tissues, and as they consequently produce thickening and enlargement.

3. If we omit the principles which, like strychnia, determine contraction, in consequence of their action on the nervous system, there remain as agents of styptic medication only the medicines called exsiccants and refrigerants.

EMPLOYMENT OF EMETIC IN CASES OF ERYSIPELATOUS FEVER.*

BY DR. GULDBERG.

Dr. G. has in a great number of cases obtained success in administering emetic in erysipelatous fevers. By means of this medicine he obtains the resolution of even the most serious erysipelas of the face; and according to him, as Hufeland has already said, this medicine may be regarded as a true specific in phlegmasia of this kind.

REMARKS ON PROFESSOR LIEBIG'S VIEWS OF THE COMPOSITION OF URINE.†

BY GOLDING BIRD, A.M., M.D.
Assistant-Physician to, and Lecturer on Materia Medica at, Guy's Hospital.

Several statements in the recently published researches of Professor Liebig on the normal constitution of urine,‡ especially demand attention, on account of the high reputation of their distinguished author, no less than from their opposition to some of the most generally received opinions on this subject. I now venture to offer some remarks on the following points, which possess perhaps, greater interest than many others.

1. The presence of hippuric acid in the urine.

2. The functions of the tribasic phosphate of soda.

1. *Hippuric Acid.*—We are almost exclusively indebted to Liebig for all the knowledge we possess of this substance. Long mistaken for benzoïc acid, the latter was stated by Scheele to be a constituent of the urine of infants at the breast, and by Rouelle, to exist in that of herbivorous quadrupeds. These errors admit of very ready explanation in the circumstance that hippuric acid becomes converted into benzoïc by the process of putrefaction, and hence if the urine examined by the above chemists had been kept for some time before analysis, benzoïc acid would be of necessity generated. On account of the great readiness with which hippuric acid crystallises, and its very insoluble character, it is a matter of surprise that it has never been previously detected in the urine of the human adult. Lehmann has indeed announced its presence in diabetic urine, but this was regarded as almost peculiar to the disease.

There cannot exist the slightest doubt of the accuracy of Liebig's statement of the presence of this acid, as it may be readily obtained by the process he has suggested. I find the following plan to be somewhat easier in execution than that recommended by the professor of Giessen.

About 20 ounces of urine are evaporated over a charcoal-chauffer or sand-bath to about an ounce. Nearly three drachms of strong hydrochloric acid are then added, and the mixture is boiled nearly to dryness. When cold, about two ounces of water are poured on the mass, and the whole well and repeatedly stirred. A brown solution is formed, and must be decanted from the insoluble residue, which consists chiefly of a mixture of hippuric and uric acids. Some of this deposit may be boiled in alcohol, and the filtered fluid allowed to evaporate in a glass capsule, when needles of hippuric acid will be left. Or a portion may be placed in a test-tube, digested with a little ether, and a few drops of the ethereal solution evaporated spontaneously in a watch-glass will leave thin and delicate needles of hippuric acid. So very readily does this acid crystallise, that from a drop or two of the alcoholic or ethereal solution, three or four delicate four-sided, exceedingly slender needle-like prisms, half an inch long, may be obtained. Sometimes these needles are not visible at first in a satisfactory manner, but after a few hours they increase in size and become beautifully distinct.

As hippuric acid, although infinitely more soluble than the uric, requires about 400 times its weight of cold water for solution, it cannot find its way into the urine in any quantity unless combined with a base, and this in the majority of instances appears to be soda, all the alcoholic hippurates being very soluble. It is now a well-recognised

* *Zeitschrift für die Gesammte Medicin.*
† From the *London Medical Gazette.*
‡ *Lancet* for June 1st and 8th, 1844.

fact, that benzoïc acid, when taken as a remedy either free or combined, is not, like the citric, tartaric, acetic, and other vegetable acids less rich in carbon, converted into carbonic acid, but uniting with a nitrogenised substance, is converted into hippuric acid. This substance was supposed to be lactate of urea, and thus the change was at once satisfactorily explained; but this hypothesis must be abandoned, if Liebig's opinion of the absence of lactic acid in urine be correct.

The proportion of hippuric acid existing in urine has not been ascertained; Liebig has supposed it to be equal in quantity to the uric. This has, however, not been the case in the experiments I have made; the utmost proportion obtained by myself never exceeded in quantity one-third the uric acid present. If hippuric acid be formed in the organism from the nitrogenised elements of the food, we must expect it to be inconstant in quantity; as must, indeed, be every element of an excretion whose origin is traced immediately to a metamorphosis of the ingesta.

It may, however, be reasonably asked whether hippuric acid may not under certain circumstances perform another function, for its composition certainly suggests the probability of its being the vehicle by which carbon may under certain conditions be eliminated from the system. Although the essential function of the kidneys is unquestionably to filter off highly nitrogenised elements from the body, yet these organs can, as every case of inflammatory jaundice teaches, for a time compensate for the deficient functions of the liver, and eliminate bile from the blood; the urine hence becoming of a deep porter colour, and bitter. But in cases where the functions of those organs whose duty it is particularly to separate carbon from the blood (the liver and lungs), is merely partially interfered with or imperfectly performed, it would be very interesting to ascertain whether the kidneys compensate for these deficiencies by eliminating carbon from the blood in the form of hippuric acid. An examination of the urine in cirrhosis of the liver, and in an extreme case of pulmonary empyema, would probably afford an answer to this interesting question.* A comparison between the per centage composition of dry hippuric acid, and the analysis of Dr. Kemp of the organic constituent of human bile, will show the analogy between them, *quoad* the proportion of carbon:—

*Human Bile.**		*Hippuric Acid.*†
Carbon . .	68·40	63·93
Nitrogen .	3·44	8·21
Hydrogen .	10·13	4·64
Oxygen . .	18·03	23·22
	100·	100·

2. *Tribasic phosphate of soda.*—Phosphoric acid in combination with lime, perhaps magnesia, soda, and, according to Berzelius, ammonia, has been long known as an important constituent of urine. From the analysis of the late Dr. Simon‡ nearly $2\frac{1}{2}$ grains of phosphate of soda are present in 1000 grains of healthy urine of specific gravity of 1·012. The phosphate of soda of urine is identical with the well-known pharmaceutical salt, and consists of—

1 atom phosphoric acid = 72
2 atoms soda . . . = 64
1 atom basic water . = 9

145 = the dry salt.

24 atoms water of crystallisation . } 216

361 = the crystallised salt.

On this hypothesis the atom of phosphoric acid, as generally assumed, is doubled, consisting of $P_2 O_5$ instead of $PO2\frac{1}{2}$. This salt becomes invested with peculiar importance from the functions assigned to it by Liebig of being the solvent for the uric (and hippuric) acid, as well as being the source of the natural acid reaction of urine. The number of opinions on the latter subject which have been published from time to time are well known; the acid reaction having been attributed in turn to uric, lactic, and carbonic acids, as well as to hydrochlorate and biphosphate of ammonia. Liebig has shown that it is probably owing to an acid phosphate, as free phosphoric acid, produced at the temperature of the body by the action of uric (and hippuric) acid on the tribasic phosphate of soda. A solution of uric acid

* Since the above was written, a man, labouring under jaundice, came under my care at Guy's Hospital. He was an habitual drunkard, and had a contracted, probably a hob-nail liver. The urine was pale porter-coloured, and, when concentrated by evaporation, yielded with hydrochloric acid a deposit rich in hippuric acid, being nearly entirely soluble in alcohol.

* Letter to Professor Liebig, London, 1844, page 37.

† Dumas, *Traité de Chimie*, Paris, 1835, page 219.

‡ Franz Simon, *Medizinische Chemie*, Berlin, 1842, b. ii. s. 235.

in water by the acid of that salt has been termed "artificial urine;" a name not very happily chosen, as such a solution bears no possible resemblance to urine save in that of containing in solution two of its ingredients. Liebig states that when 15 grains of uric and as much of hippuric acid were heated in a solution of 40 grains of dry phosphate of soda in a pound of water, the whole formed a clear acid fluid, and on cooling very slowly deposited half of its uric acid; "this sediment is of an analogous form to that deposited by natural urine after standing at rest for a long time."

It is well known that 8·1 grains of uric acid are on an average separated from the blood by the kidneys in the course of 24 hours. This quantity is contained in about 40 ounces of water, or not quite 2,500 times the weight of the acid, which from the accurate experiments of Dr. Prout, requires about 10,000 times its weight of water for solution: consequently it is impossible to suppose that uric acid can exist in urine in a free state unless the existence of unknown causes modifying its solubility be supposed. Some indeed have, as I believe, on very insufficient data, attributed this function to the coloring matters of urine. The difficulty has been satisfactorily met long ago by Dr. Prout, who supposes uric acid to exist combined with ammonia, forming a salt which requires but 480 parts of water for solution. This opinion has been adopted by most observers who are at all acquainted with the phenomena presented by the urine, and so completely supported by a great mass of evidence, that there can, I think, be no difficulty in regarding the urate of ammonia as the normal state in which at least a part of the acid under consideration exists in healthy urine, and in the colored amorphous deposits. It frequently happens, however, especially when an inflammatory diathesis exists, that uric acid is deposited in crystals more or less colored, and differing essentially from the amorphous deposits in merely becoming opaque, and not dissolving in the urine when heated. These crystalline deposits have been explained by the presence of some acid, which, by combining with the ammonia, precipitates the uric acid. This precipitant has been generally regarded as lactic acid, or occasionally the sulphuric. As the presence of the former in urine must now be regarded as doubtful, and even if admitted hardly explains the phenomena alluded to, some other explanation of the reason why urine sometimes deposits free and at other times combined uric acid, or, as often occurs, both simultaneously, is required. This explanation is, I think, satisfactorily found in the peculiar action of uric acid on the phosphates, to which attention has been drawn by Professor Liebig.

Having prepared some perfectly pure uric acid, I made the following experiments:—

A. Ten grains of crystallised phosphate of soda were dissolved in an ounce of hot distilled water, and to the alkaline solution thus formed, four grains of pure uric acid in minute tabular crystals were added: the whole soon dissolved, and was filtered through paper whilst hot. On cooling, a slight troubling occurred, and in twelve hours a copious crystalline deposit had taken place. This was collected and dried.

B. Under the microscope the deposited crystals were found to consist of transparent colorless prisms arranged in fasciculi and stellæ, exactly resembling a variety of crystalline deposit of not very frequent occurrence in urine, and remarkable for presenting a marked difference to the usual lozenge-form of uric acid crystals.

C. Boiled in water, these crystals did not dissolve; the only change detected by the microscope was the breaking up of most of the fasciculi, and the transparency of the crystals being lost.

D. By digestion in warm and strong hydrochloric acid, the crystals underwent no further change than when mere water was employed.

E. Ignited in a platinum spoon, after digestion in the acid (D), they burnt to a black ash with the odor peculiar to uric acid; by continuing the heat, a white fused bead was left, which dissolved in water, did not effervesce with acids, and consisted of phosphate of soda.

F. The fluid decanted from the crystalline deposit (A), was clear, and reddened litmus paper. A few drops of hydrochloric acid caused after a few minutes a deposit of uric acid in flat tables excavated at the sides, being the same form as the acid originally employed. By ignition, these crystals scarcely left a perceptible stain on the platinum spoon, and hence contained neither soda nor its phosphate.

G. Some healthy urine was mixed with hydrochloric acid, and after repeated agitation during 24 hours, was decanted from the precipitated uric acid. On examining the latter under the microscope, the crystals were found to present the form erroneously described as cylindric, being composed of very thick yellow lozenges, with the obtuse angles rounded off, so that when lying on their sides they so closely resemble cylinders that, until allowed to roll over, it was impossible to dispel the idea of such being their figure.

H. The acidulated urine filtered from uric acid (G) was mixed with the fluid

decanted from the crystalline deposit (A). An almost immediate deposit occurred. which, when examined by the microscope, exactly resembled in figure the uric acid precipitated from urine (G), being in thick obtuse lozenges, and did not bear the slightest resemblance to the crystals deposited from the same fluid and hydrochloric acid (F), unmixed with the urine. Indeed, they only differed from the crystals (G), in being pale lemon, instead of orange-colored.

These experiments prove that uric acid, without the presence of hippuric acid, will decompose phosphate of soda when aided by heat, producing an acid phosphate and basic urate of soda; the former causing the solution to redden litmus, and hence giving us a key to the long-contested question of the acidity of healthy urine. Professor Liebig has further shown, that on cooling, and by repose, half the uric acid is deposited, still leaving the supernatant fluid sufficiently acid to redden litmus paper. This deposit certainly, however, does not possess the properties of the common urinary sediment, as it is in large and well-defined crystals, and does not dissolve in boiling water, or change in hydrochloric acid, whereas the deposit in question is amorphous, readily dissolving in boiling water, and hydrochloric acid converts it into rhomboidal crystals of uric acid. The deposit from Liebig's "artificial urine" (A), does, however, so closely resemble the less frequent crystalline uric deposits, as to leave no doubt of the immediate cause producing them being identical.

The crystals spontaneously deposited (A) differ materially in crystalline form from those precipitated by hydrochloric acid (F), the former being in prisms and stellæ, the latter in thin tables excavated at the sides, a form which I have never seen in urinary deposits. The cause of this difference in crystalline form is readily explained by the spontaneously deposited crystals containing phosphate of soda in all probability chemically combined, as neither boiling water nor hydrochloric acid removed it (C, D, E). The influence of the coloring matter of urine in altering the crystalline form of uric acid is beautifully shown in the action of acidulated urine, from which the uric acid had been separated (G), upon the solution of uric acid in the phosphate (H), the crystals neither being in prisms nor stellæ, but in thick obtuse lozenges, exactly resembling those thrown down from urine by the acid, and bearing no resemblance to those precipitated from the same solution, either spontaneously, or by pure hydrochloric acid.

The property announced by Liebig of the action of uric acid on phosphate of soda, and which, as Lipowitz* has shown, is also exerted on alkaline acetates and lactates, thus appears to lead to a satisfactory explanation of the acidity of healthy urine, and to the formation of crystalline uric acids. But to the ordinary amorphous deposits which disappear on heating the urine, and present the least amount of deviation from health, this explanation will not apply; Dr, Prout's opinion of the uric acid normally existing as urate of ammonia being most in consonance with observed facts, and sufficient to explain all the known phenomena presented by this class of deposits.

It is possible, then, to explain the formation of urate of ammonia in the urine consistently with the opinion of Liebig regarding the source of its acid reaction? It is obvious that such cannot be done if a soda salt be regarded as the solvent; but if it be shown that a phosphate of ammonia possesses similar properties, the opinions of Drs. Prout and Liebig admit of complete reconciliation. Chemists are well acquainted with a compound, long known as microscomic salt, which crystallises spontaneously from putrescent urine. This salt is, like phosphate of soda, tribasic, and differs from that compound only in one atom of soda being replaced by one of oxide of ammonium: it therefore consists of—

1 atom	phosphoric acid	72
1 ,,	soda	32
1 ,,	oxide ammonium	26
1 ,,	basic water	9
		139 = dry salt.

This double phosphate, or at least its elements, exists in urine, and appears among its acknowledged constituents in most of the published analyses.

I made the following experiments, to ascertain how far this salt exerted a solvent power over uric acid:—

I. Ten grains of the double phosphate in crystals were dissolved in an ounce of hot water; the solution exerted an alkaline reaction. Four grains of pure uric acid, in tabular crystals, were then added, and the mixture heated. Part only of the acid appeared to dissolve; the undissolved part evidently underwent some change, becoming snow-white and denser, the supernatant fluid losing its alkaline reaction. On cooling, it deposited urate of ammonia in microscopic needles.

K. The white undissolved portion (I) was placed under the microscope: no trace of tables of uric acid could be detected, the whole being changed into minute delicate

* *Simon, Bertrage zur Physiologischen Chemie*, Berlin, 1843, b. i. s. 97.

needles of urate of ammonia. These readily dissolve in hot water, and were deposited in part on cooling.

L. The fluid filtered from the deposit (I) was neutral to test paper; on the addition of hydrochloric acid, it slowly deposited tabular crystals of uric acid. By long repose a very few prismatic crystals of the same substances were deposited without the addition of any precipitating acid.

M. The fluid separated from the deposited urate of ammonia dissolved an additional portion of uric acid when more was stirred in, and heat applied. The solution was perfectly clear, and acid to test-paper. On cooling, it deposited an abundance of acicular urate of ammonia, and after long repose also let fall prismatic crystals of uric acid.

These experiments appear to me to explain in a most satisfactory manner the phenomena presented by the urine so far as uric deposits are concerned. Uric acid, agreeably to Dr. Prout's view, exists chiefly combined with ammonia, which base I believe it obtains from the triple salt of soda and ammonia; and it is this proportion which is deposited in an amorphous form by cooling the urine, or evaporating it in *vacuô*. Another portion of the acid decomposes the soda element of the double salt, agreeably to Liebig's opinion, and is deposited, in combination with a little phosphate of soda, in crystals by very long repose, even in closed vessels; or much sooner when an excess of the acid is separated from the blood by the kidneys. That urate of ammonia is first formed in the greatest abundance by the action of uric acid on the triple salt is shown by experiment (I), and after the deposition of this the residual fluid possesses the property of dissolving more acid, rendering the solution acid to test-paper. Thus it is probable that when the triple salt is acted on by uric acid, its ammoniacal element is first partially decomposed, and on the addition of more uric acid its soda element partly yields; in both cases a superphosphate is formed capable of giving to urine its natural acidity.

From this reasoning we should expect that if the proportion of uric acid present in the urine is within certain limits, it would constitute only an amorphous sediment of urate of ammonia, but that when found in large excess, as when a calculous diathesis exists, we should expect it to be deposited in crystals, and nearly in a pure state. The same theory also readily explains the very frequent simultaneous occurrence of amorphous and crystalline uric deposits.

There is one very essential difference between the mutual behaviour of phosphate of soda and uric acid, and of the same acid with phosphate of ammonia. The former salt, as stated by Liebig, is decomposed by uric acid at a temperature of about 100°, urate of soda being formed, and an acid phosphate left in solution. On cooling, this acid decomposes the urate of soda, setting free uric acid; or, in other words, uric acid decomposes phosphate of soda by heat, but in the cold phosphoric acid decomposes urate of soda. It is obvious, however, that this decomposition is but partial, otherwise Liebig's theory would fail to explain the acidity of healthy urine. Phosphate of ammonia, on the other hand, as we have seen, acts very differently (I); it is (in the state it exists in the microscomic salt) decomposed in part by uric acid when heated, and urate of ammonia is formed, on which salt the acid phosphate generally does not act by cooling. Pobably the insolubility of the urate of ammonia by removing it out of the sphere of action of the acid salt, may partly explain this discrepancy between the action of uric acid on the ammoniacal and soda phosphates.

One important practical hint may be drawn from these observations; viz., the probably successful treatment of uric acid gravel by the administration of phosphate of soda. If sufficiently diluted, this salt is sure to enter the circulation and be excreted by the kidneys, thus furnishing to the urine an energetic solvent of uric acid. It is true that this indication can be generally fulfilled by the pure alkalies and their carbonates, but they too often exert the injurious effect of materially interfering with the digestive organs, and thus directly affecting the integrity of those functions most intimately connected with the production of the morbid deposit. The phosphate of soda may be given in doses of ℈j. to ʒss. thrice a day without any other apparent effect except that of slightly relaxing the bowels, and the urine becomes charged with the salt. We may thus hope to retain uric acid in solution, and gain time for the employment of those remedies which are best adapted for the treatment of the uric diathesis. For it must never be forgotten that in merely giving a remedy to hold an urinary deposit dissolved, we are merely treating an effect, and not a cause.

Before concluding these remarks, I would venture to correct one statement of Professor Liebig, which is certainly erroneous; viz., that alcohol has never been detected in the urine. In the elaborate essay of a most talented and experienced physician and chemist, Dr. Percy, of Birmingham,* an experiment is related in which a bitch was poi-

* Prize Essay on the Presence of Alcohol in the Brain. London, 1839, p. 23.

soned by alcohol, and traces of it were, after death, detected in the brain, blood, urine, and bile. The tests employed were the inflammability of the distilled fluid and its power of dissolving camphor; and hence no doubt can exist as to the real presence of alcohol in the substances examined.

ON THE FORMATION OR SECRETION OF CARBON BY ANIMALS.*

BY MR. ROBERT RIGG.

The scientific world is at present much occupied with the application of chemistry to animal and vegetable physiology; and it may be interesting to some of your readers to know, that by a few very simple experiments they may satisfy themselves upon that branch of the subject which relates to the formation of carbon by animals.

Suppose an animal, which comprises in its whole system 50 parts by weight of carbon, to be kept for five days, during which it consumes other 50 parts, it is evident that if during the five days it gives to the atmosphere 60 parts, and at the end of that time it is found to have increased its weight of carbon by 10 parts, there is a positive gain of carbon equivalent to 20 per cent.

The experiment may easily be made upon young small animals. Take two of these so nearly alike that there can be no material difference in the weight of the carbon they comprise. Kill one of these, and expose it to a temperature not exceeding 220°, for two or three days; it may then be powdered, and by subjecting an average sample to analysis with oxide of copper, the weight of carbon comprised in the entire animal may be determined with the greatest certainty. The other being supplied with food, the weight and chemical constitution of which is ascertained, should be kept in a limited atmosphere, which must be tested and changed every one, two, or three hours,† the increased proportion of carbonic acid of that atmosphere will show the quantity of carbon given off by the animal in the course of the experiment; and the increase or decrease of carbon in the animal itself may be ascertained in the manner above mentioned.

In this manner I have experimented upon many animals; and without taking account of the carbon which passes off otherwise than by respiration, the result has invariably been a great increase of carbon—an increase which cannot be accounted for, unless we conclude that carbon is secreted by animals.

Amongst my best experiments are those made with young mice. A healthy young mouse, weighing 200 grains, comprises in its constitution from 25 to 30 grains of carbon; when fed daily with 60 grains of bread moistened with water, containing about 16 grains of carbon, it increases in weight, and imparts to the atmosphere from 20 to 26 grains of carbon, the quantity varying generally with the quietness or the habits of the animal. A kitten, from six to ten weeks old, when supplied daily with four fluid ounces of skim-milk, containing 66 grains of carbon, will increase in weight, and impart to the atmosphere from 80 to 110 grains of carbon.

Either of these two animals may be kept without food until they give off by respiration a weight of carbon equal to 80 per cent., and retain from 60 to 70 per cent., of that which they comprised at the commencement, showing that a weight of carbon equal to 40 per cent. had been secreted. The experiment may also be made with birds supplied with little or no food. A tomtit was placed under experiment without food; the bird was violent and restless during its imprisonment. In sixteen hours it imparted to the atmosphere 65 per cent. of carbon, when it appeared to die of exhaustion, and retained 77 per cent. of the weight of carbon it originally contained; showing a secretion of carbon in sixteen hours, when under violent exertion, equal to 42 per cent.

On making the carbon in the food, and that in the air respired by a full-grown person, the basis of our calculation, we obtain results which favor the conclusion that carbon is likewise secreted by man. Physiologists estimate the weight of carbon in the air respired by an adult at from 5,000 to 6,000 grains per diem. I have subjected to analysis many articles of food, and found this weight of carbon far to exceed that in the food consumed by most laboring men, who may be supposed to impart to the atmosphere the greatest weight of carbon. A person eating each day after the following rate will consume 6,000 grains of carbon:—

Rump steaks	1 lb.	contg.	1,059 gr. carbon.
Bread	1½ do.	,,	2,830 ,,
Potatoes	½ do.	,,	310 ,,
Porter	2 pts.	,,	760 ,,
New milk	2 fl. oz.	,,	57 ,,
Butter	½ oz.	,,	320 ,,
Cheese	1 do.	,,	150 ,,
Sugar	2 do.	,,	350 ,,
Coffee	1 do.	,,	96 ,,
Tea	1 do.	,,	80 ,,
			6,003

* *Medical Gazette*, Aug. 23, 1844.

† The health of animals appears to be affected by an atmosphhere containing more than 5 per ct. of its volume of carbonic acid.

This weight of carbon is not more than is consumed by some persons who are actively employed, but it far exceeds that in the food of our laboring population; and on comparing it with that allowed for each adult in the different workhouses, &c. we have in the dietary of the—

	Per Cent. of this 6,000
City of London Union	75
Brentford do.	50
Uxbridge do.	55
Aylesford do.	56
Macclesfield do.	44
Westminster New Prison	57
Milbank Penitentiary.....	80
House of Correction, Clerkenwell..	53
Hanwell Lunatic Asylum.....	75

And if we make the carbon in the food of some of our agricultural laborers the subject of comparison, we find the deficiency greater than in any of the above mentioned dietaries.

I could add to these many other experiments, which furnish, in my opinion, irresistible evidence of the secretion of carbon by animals. If an animal be kept without change of circumstances, or of diet, except as to the quantity of food, it will be found that the weight of carbon in the air respired does not vary in proportion to that consumed in the shape of food. On the contrary, the deficiency of carbon supplied seems to be met by an extraordinary effort of the animal system, as appears from the following results of accurate observation:—

	In the Food.	In the Air respired.
If an animal in the first 24 hours has a plentiful supply of food, there is.....	80 grains of carbon.	100
In the next 24 hours a less quantity....	70 ,,	94
,, ,, a sparing do.	60 ,,	87
,, ,, a small do.	50 ,,	78
,, ,, a very small do. ..	40 ,,	65

But if the animal, instead of having its quantity of food varied, should be sometimes left in a quiescent state, and sometimes excited to great activity, the weight of carbon given off will be found to vary in proportion, within certain limits, to the activity of the habits of the animal, and the exertion called forth.

If the carbon in the food be represented by	100
That given off by an animal of easy habits will be.....	110
That given off by an animal of active habits will be.....	130
Do. do. when under exertion....	140
Do. when under great exertion..	150

If the animal be both stinted of food, and excited to great activity, the difference between the carbon comprised in the food and that given off by the animal is as follows:—

	In the Food.	Given off.	Difference.
Carbon....	100	120	20
,, ...	80	105	25
,, ...	60	90	30
,, ...	50	85	35

Hence food is a substitute for expenditure of animal strength. To this may be added, that when an animal is distressingly exercised, the weight of carbon in the carbonic acid given off by respiration is at first increased, afterwards gradually diminishes, and becomes much less when the animal is in a state of exhaustion. Rest alone is not then sufficient, but rest and food soon restore the strength of the animal; and with its strength its power of secreting carbon—a power which I conceive to be essential to animal life, and which will probably furnish a solution to some of the most difficult problems of animal physiology, including that of the generation of animal heat.

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THE CHEMIST.

I. CHEMISTRY.

ON MELLON AND ITS COMBINATIONS.*

BY. J. LIEBIG.

In my essays on the products obtained by treating the soluble metallic sulphocyanides with nitric acid or chlorine, I described, under the name of sulphocyanogen, a yellow pulverulent body, containing carbon, nitrogen and sulphur in the same proportions as they are found in the radical of hydrosulphocyanic acid. In four experiments (*Pogg. Ann.*, vol. xv., p. 557) on combustion with oxide of copper, I obtained from 3 to 9 per cent. of water; this difference of quantity induced me to presume that the amount of hydrogen does not make part of the constitution of this body. In a later article (*vide* these (Liebig's) Annals, vol. x., p. 8) I showed that on treating fused sulphocyanide of potassium with dry hydrochloric acid, the hydrosulphocyanic acid disengaged is, previous to entering the receiver, for the most part decomposed. The neck of the retort is covered by a dense mass of a dark red, or yellow-red, and in some places of a bright red color; during this process no permanently elastic gas escapes, but all the volatile products may be condensed in cold water; by the hydrochloric acid the water becomes very acid, bisulphuret of carbon is precipitated under the form of limpid drops; a strong odor of hydrocyanic acid is perceived, and the liquid, on evaporation, yields sal-ammoniac, which, in conjunction with formic acid, is, as we now know, produced by treating strong hydrochloric acid with hydrocyanic acid. The solid mass deposited in the neck of the retort was found to be easily soluble in alcohol; considerable quantities of it were dissolved in boiling water, which, on cooling, were again thrown down as a yellow-red powder; its solution precipitated nitrate of silver in dense yellow flakes, which, on being heated in the liquid, disengaging gases, became black or grayish black.

This body being crystallisable and soluble in water, was afterwards analysed in our laboratory by Woskresensky, who expressed its composition by the formula $C^2 N S^3 H$. According to this formula, it may be considered as a combination of hydrosulphocyanogen with sulphur, hence the name of hydropersulphocyanic acid under which I described that substance in my Organic Chemistry (Geiger's *Handbuch*, p. 650). The accuracy of Woskresensky's analysis was afterwards corroborated by Völkel, who more closely investigated the products resulting from the decomposition of hydrosulphocyanic acid when treated either alone, or with water or acids, and who perfectly elucidated the subject. Wöhler first noticed that the hydrosulphocyanic acid when left to itself, is decomposed into hydrocyanic acid and hydropersulphocyanic acid, and Völkel showed that whenever hydrosulphocyanic acid in a rather concentrated state is disengaged from a sulphocyanic combination, part of it is constantly transformed into these two products; such, for instance, is the case when a solution of sulphocyanide of potassium is saturated with hydrochloric acid gas, or when some strong hydrochloric acid is thrown on the dry salt, and at the common temperature left to itself.

But since on preparing the so-called sulphocyanogen by means of chlorine, the solution of sulphocyanide of potassium soon becomes very acid, it is evident that the products which, by the action of chlorine, are obtained at the beginning of the process, must differ from the later and last ones, for at first it is the combination of potassium, and afterwards, when the liquid becomes acid, it is the hydrosulphocyanic acid which is decomposed by the chlorine. In addition to this a decomposition of the hydrosulphocyanic acid takes place by itself, and by the action of chlorine on the then formed hydropersulphocyanic acid peculiar products arise.

According to the later and more accurate analyses of Parnell, the so-called sulphocyanogen (obtained by chlorine at a low temperature) contains the elements of 4 atoms of sulphocyanogen, 2 atoms of hydrosulphocyanic acid, and 1 atom of water; and, according to that of Völkel, 3 atoms of sul-

* *Annalen der Chemie und Pharmacie*, June, 1844.

phocyanogen, 1 atom of hydrosulphocyanic acid, and 1 atom of water. If the body was prepared without recourse to artificial cold, the number of atoms of the other elements remaining the same, that of sulphur was observed by Völkel to be augmented by one; and if nitric acid was employed in its preparation, the amount of sulphur was again different from both the aforesaid kinds. In all these cases much less than one equivalent of hydrogen for every two equivalents of carbon was obtained.

It is easy to perceive what now, since the behavior of hydrosulphocyanic acid is better known, may be anticipated with more certainty, that the so-called sulphocyanogen is most probably a mixture of several combinations, and that its being obtained of a constant composition may be attributed to mere accident.

The amount of oxygen of this body seems to me to be very problematic, this element constituting no more than 3½ per cent., which can be brought into account merely as loss. On distilling the so-called sulphocyanogen, we obtain, except water, no product containing oxygen.

With regard to the determination of the hydrogen in this kind of bodies, it cannot be overlooked how difficult it is to ascertain whether the hydrogen obtained as water makes part of its constitution; or is merely accidental. Agreeably to this, Völkel, for instance, analysing the persulphocyanide of lead, on combustion with oxide of copper, the heat being augmented to a degree which might nearly disengage bisulphuret of carbon, obtained in one analysis for 6·46 per cent. carbon 0·229 per cent. hydrogen, and in a second analysis for 6·50 carbon, 0·320 hydrogen.

These quantities of hydrogen do not amount to one equivalent for every two equivalents of carbon. But if, on examining the so-called sulphocyanogen, we, with Völkel, take from 8 to 12 equivalents of carbon, we obtain from 3 to 6 atoms of hydrogen. As I stated before, I sometimes, after combustion of that body, obtained as much as 9 per cent. of water, and can scarcely doubt that there is water in it; for, by dry distillation, when the heat began to act, the hydrosulphocyanic acid was undoubtedly disengaged always before the bisulphuret of carbon made its appearance; but I consider this hydrogen as an accidental, not as a necessary, ingredient of the so-called sulphocyanogen.

With reference to the true nature of this yellow body, excepting some concordant analyses, no further progress has been made. Ammonia without heat dissolves the greatest part of it, leaving, on boiling, a very little residue. These solutions give with acids a bright yellow, flaky precipitate. Dissolved in potash ley, the color of the solution becomes of a dark red, turning, by continued boiling, into a bright yellow; and on being afterwards treated with acetic acid, it throws down, with vivid effervescence, a precipitate which is composed of sulphur and a pale yellow body, soluble in ammonia and in boiling water, which latter solution, on cooling, precipitates it again in the form of very bright yellow flakes. On decomposing this so-called sulphocyanogen by potassa, no observable trace of ammonia is disengaged; it consequently seems to be likely that the whole amount of its nitrogen remained in the products soluble in water and ammonia. These two bodies have been mentioned here, because, especially one of them, forms the starting point of the investigations on mellon: for I found that the so-called sulphocyanogen, at a temperature lower than the boiling point of mercury, resolved into bisulphuret of carbon, sulphur and a yellow pulverulent substance free from sulphur, and that it cannot be entirely volatilised without a strong red heat. Besides, a trace of hydrosulphocyanic acid, in this decomposition of the sulphocyanogen, no product containing hydrogen or nitrogen is obtained.

I could not succeed in obtaining, in a pure state, that is to say of a constant composition, the body which is left after the dry distillation of the so-called sulphocyanogen, and which containing nitrogen, is free from sulphur and unchangeable at a gentle red heat.

The analyses varied with regard to carbon from 2 to 3 per cent., and various quantities of water were also obtained on combustion, and in several cases potassa was discovered in the residue. All these irregularities may be accounted for by the inconstant composition of the so-called sulphocyanogen, and for this reason I could not publish any of these analyses. According to the notion which I formed, after my first experiments on the decomposition of the so-called sulphocyanogen, the body remaining, after it was decomposed by the influence of heat, ought to have all the nitrogen contained in the sulphocyanogen. I now found, that at a strong red heat, it entirely disappears, being decomposed into a mixture of gases, the last portions of which show a constant proportion. This mixture of gases, on being ignited, burns with a purple red flame; if passed over potassium it combines with part of it, exhibiting phenomena of ignition, at the same time cyanide of potassium and nitrogen are obtained. Of four volumes of it three are absorbed by potash ley, and the residue left at the period when nitrogen and

cyanogen are disengaged in the proportion of one to three, yields on combustion with oxide of copper, nitrogen, and carbon in the proportion of three to two.

By this it appeared that this product of the decomposition of sulphocyanogen which is free from sulphur for every 6 atoms of carbon, must contain 4 equiv. nitrogen, which accounts for the formation of it, as well as for that of all other collateral products. If we assume, that from 4 elements of sulphocyanogen, the elements of 2 atoms of bisulphuret of carbon and 4 atoms of sulphur are separated, a body must remain containing 4 equiv. nitrogen for 6 equiv. carbon.

$$C^8\ N^4\ S^8 \left\{ \begin{matrix} C^6 & N^4 \\ C^2 & S^4 \\ & S^4 \end{matrix} \right.$$

This diagram, representing the decomposition of the sulphocyanogen, does not alter, even if hydrogen were a constituent part of the so-called sulphocyanogen. If the amount of hydrogen were to be 1 equiv., then, no products containing it being perceptible, this must, together with 6 equiv. carbon, and 4 equiv. nitrogen, remain in the residue, and this latter ought to be decomposed by itself, yielding, at a high temperature, at first hydrocyanic acid and nitrogen, and ultimately cyanogen and nitrogen. I found, then, that potassium, on being heated with that residue, exhibiting phenomena of ignition, enters with it into a combination which may be fused, and which is soluble in water. This solution has a taste similar to that of bitter almonds, from which voluminous white flakes are thrown down by acids, which are readily redissolved in an excess of alkali.

I then designated this body by the name of mellon, and from its appearance I thought myself warranted in making it in the class of compound radicals. On heating the sulphocyanide of potassium in dry chlorine gas, I likewise obtained this mellon in considerable quantities, and ascertained the alterations produced by the influence of nitric acid and the potash ley.

This investigation, with reference to the nature of mellon, remained incomplete, and the views based thereon required to be better founded; and I would, perhaps, have already repeated it, had not an excellent investigation of L. Gmelin been soon after communicated to chemists, concerning a collateral product obtained in the preparation of sulphocyanide of potassium, by which, as it seemed to me, the chemical character of mellon was established, and every doubt relative to its real nature removed. On preparing the sulphocyanide of potassium from ferrocyanide of potassium and sulphur, this mixture, ferrocyanide of potassium, (Graham, p. 452), was heated somewhat beyond the point, at which it ceased to impart to the salts of protoxide of iron a blue color; next the mass was dissolved in water, the iron precipitated by potassa, the ley reduced to dryness and boiled with alcohol. This solution, kept for a longer time in a cold place, deposited a small quantity of a peculiar crytstallised salt, which, perfectly pure, did not redden the salts of oxide of iron, contained no sulphur, was thrown down by acids as a gelatinous mass, and, on being treated with the salts of lead, yielded a white precipitate, which L. Gmelin subjected to analysis.

From this analysis it appeared that this salt of lead, in its crystalline state represented a combination of mellon with lead containing 5 atoms of water, 4 of which escape at a temperature of 266° F., in such a manner that the residue may be considered as a hydromellonate of oxide of lead, resembling the cyanide of lead by the circumstance that without water, or another substance, it cannot subsist entire.

Gmelin described, in addition to this, the mellonide of potassium, and its behaviour with acids and metallic salts, of which I will treat more fully in the sequel. If, before describing my further researches with regard to the labors and results of others (Völkel's and Gerhardt's), who seem to speak against the existence of mellon as a body of itself, or against its nature as a compound radical, I say no more than I have read them, I do so with the intention to consider them in the following pages.

To find the materials necessary for experiments, it was, in the first place, essential to contrive a simple and easy method for the preparation of a combination of mellon.

Several ways led to that, some of which I have already pointed out in Geiger's *Handbuch*. If the residue obtained in the distillation of the so-called sulphocyanogen, which I shall designate as impure mellon, is put into fused sulphocyanide of potassium, a vivid effervescence is observed, produced by the disengagement of bisulphuret of carbon and sulphur; and if the mellon employed amounts to about one fifth of the weight of the sulphocyanide of potassium, a brown opaque glassy mass is obtained, soluble in hot water without residue, yielding, on evaporation, crystals of hydrated mellonide of potassium.

A preferable method, and by which a larger quantity may be obtained, is the following:— sulphocyanide of copper ($Cy\,S^2\,Cu^2$) is procured by precipitation from a mixture of 3 parts of sulphate of iron, and 2 parts of

sulphate of copper, with sulphocyanide of potassium. The precipitate is to be first washed with diluted sulphuric acid from which it obtains a pure white color, and then more completely by pure water, and next dried on bricks. If the sulphocyanide of copper be heated on an open fire, in a porcelain capsule until it begins to assume a brownish color, it is obtained perfectly anhydrous, and qualified to serve for the following operation:—Three parts of the sulphocyanide of potassium are melted into a vessel to be closed by a cover, and on continually augmenting the heat two parts by weight of the dried sulphocyanide of copper are added in small portions, and stirred; on introducing the sulphocyanide of copper into the melted mass, each time a vivid effervescence takes place, occasioned by the disengagement of bisulphuret of carbon, this being spontaneously inflammable. After the whole has been added, the heat is augmented until the bottom of the iron vessel becomes red hot, and this temperature is kept up until no farther disengagement of bisulphuret of carbon is perceptible. At this moment 1½ to 2 ounces of well powdered and freshly ignited carbonate of potassa are added for every 16 ounces of sulphocyanide of potassium; on the addition of which the dense and pulpy mass becomes soft and liquid, at the same time a vivid effervescence and disengagement of carbonic acid are observed. If at a gentle heat the mass was reduced to a state of gentle fusion, the operation may be considered as finished. It is allowed to cool, a sufficient quantity of water poured into the iron vessel, then boiled, and the boiling solution filtered from the residue. After having been concentrated and allowed to cool, a large quantity of crystallised mellonide of potassium is obtained. In this operation, it is evident that a considerable quantity of sulphocyanide of potassium is requisite, partly to prepare the sulphocyanide of copper, partly for the purpose of transforming this latter substance into the combination of mellon. On preparing the sulphocyanide of potassium itself we may succeed with great facility in obtaining, as a collateral product, a considerable quantity of mellonide of potassium, and this method is of itself so advantageous that we should never omit to employ it. The preparation of sulphocyanide of potassium is so well known as scarcely to require more particular description. We employ a mixture of slightly roasted ferrocyanide of potassium with half its weight of flowers of sulphur, which is to be fused at a gentle heat, in a closed iron vessel. When, in the first period of the operation the mass becomes completely fluid, it is generally found to be free from any soluble ferruginous compound; for when dissolved in water, carbonate of potassa throws down no precipitate. At that period the insoluble residue is cyanide of iron, and not, as it was usually believed, sulphuret of iron. On continuing, however, the fusion in a well-closed vessel, the amount of iron found is augmented, and on gradually raising the heat, the amount of iron again diminishes, until finally no vestige of any soluble combination of iron is to be met with in the melted mass. The decrease of the amount of iron is constantly accompanied by a disengagement of bisulphuret of carbon. If, finally, when blue flames are no longer visible, as much of the dry carbonate of potassa is added as amounts to $\frac{1}{20}$ of the weight of the ferrocyanide of potassium employed; the mass becomes again completely liquid. If, after having been allowed to cool, it is boiled with water, and the solution evaporated to one half, on cooling the whole liquid is generally converted into a dense pulp offering fine felty needles of mellonide of potassium, which is collected on a filter, and washed with alcohol until the liquid which runs off no longer reddens chloride of iron. These three methods are easy to be comprehended, if we bear in mind the decomposition which the so-called sulphocyanogen by itself is to undergo. At a higher temperature, it is decomposed into mellon, bisulphuret of carbon, and sulphur.

If impure mellon is put into fused sulphocyanide of potassium, sulphocyanogen separates, and mellonde of potassium is generated; at a temperature, however, requisite for accomplishing this end, the sulphocyanogen on becoming free is decomposed into the aforesaid products, for every 4 atoms one atom of mellon is generated, by which a new portion of sulphocyanide of potassium is decomposed.

The second and third methods has reference to the decomposition which the combinations of sulphocyanogen with heavy metals undergo when treated at a gentle red heat. If dry sulphocyanide of copper (the white precipitate thrown down by sulphocyanide of potassium from a mixture of sulphate of copper and sulphate of iron) be heated in a distilling vessel bisulphuret of carbon, sulphuret of copper ($Cu^8\ S^4$) and mellon are obtained, which remains mixed with the sulphuret of copper. At a higher temperature, sulphur is driven off and mellonide of copper formed, which is only decomposed by a still higher red heat.

The same is the case with the sulphocyanide of iron placed in the fused mixture of ferrocyanide of potassium and sulphur, on pro-

tracting the fusion sulphocyanide of iron is generated, which at a higher temperature is again decomposed.

4 atoms of sulphocyanide of iron $C^8 N^4 S^8 Fe^4$ are decomposed into bisulphuret of carbon $C^2 S^4$, sulphuret of iron $Fe^4 S^4$ and mellon, or mellonide of iron $C^6 N^4 Fe$, and a mixture or a combination of sulphuret of iron ($Fe^2 S^2$) protosulphuret of iron ($Fe S^2$).

If sulphocyanide of copper at a gentle red heat is added to melted sulphocyanide of potassium, the decomposition of the copper combination takes place quite in the same way as if it had been exposed to the heat by itself; the mellon generated by the transformation of its constituent parts behaves, with regard to the sulphocyanide of potassium, in the same manner as if it had been directly put into it; mellonide of potassium is obtained, and from the sulphocyanogen, separated by the same process of decomposition, a new quantity of mellon is formed. On fusing the mixture of ferrocyanide of potassium with sulphur, sulphocyanide of iron is produced, which at a higher temperature behaves entirely like sulphocyanide of copper.

On describing the last two methods it was recommended, at the end of the fusion, to make an addition of as much of calcined carbonate of potassa as amounts to 5 per cent. of the weight of the sulphocyanide of potassium or ferrocyanide of potassium employed. This addition is not necessary, for even without it, on washing the fused mass, a large quantity of mellonide of potassium is obtained; but it is advantageous, for by this means the quantity is augmented.

It is important enough to notice, that this operation should not be undertaken with small quantities; in the instances here described 40 ounces of ferrocyanide of potassium were generally employed. A sufficiently high temperature at the end of the fusion (before the carbonate of potassa is added) is another condition to be borne in mind, with the view of obtaining pure specimens in large quantities. From the observations made in these experiments, some useful suggestions for the preparation of sulphocyanide of potassium resulted which I do not mean to pass over in silence. It will readily be perceived that, by preparing the sulphocyanide of potassium with ferrocyanide of potassium, the fusion being continued until all the iron disappears, the third part of the whole amount of nitrogen will be obtained under the form of a combination of mellon. The amount of sulphocyanide of potassium would be more than one-third, and it would be of still greater purity if enough of potassium and sulphur were present to form with the cyanogen of the cyanide of iron, sulphocyanide of iron; with a sufficient quantity of sulphur the melted mass would contain sulphuret of iron.

If then, on fusing ferrocyanide of potassium with sulphur, at the period in which the fused mass shows some iron, in which case the solution in water can contain no ferrocyanide of potassium, dry carbonate of potassa is added to the fused mass, after removing the iron, the ferrocyanide of potassium reappears in considerable quantities; the fused mass, from the watery solution of which much was thrown down by the potassa, and which precipitated no prussian blue from the salts of oxide of iron; after an addition of carbonate of potassa having been made it contains no iron, but its solution now produces, with salts of iron, a copious blue precipitate. By the addition, therefore, of the carbonate of potassa, out of the cyanide of iron which remained undecomposed ferrocyanide of potassium was again formed. If, however, to the liquid mass freshly fused liver of sulphur, in small portions, is added, the iron may be entirely removed, and, in proportion to the quantity of liver of sulphur employed, the amount of cyanide of sulphur will be found greater or less.

A mixture of 46 parts of roasted ferrocyanide of potassium, 17 of carbonate of potassa, and 16 of sulphur may be fused with great facility. At the beginning of the fusion the sulphur and the carbonate of potassa act upon one another, it swells up, and sulphuret of potassium is formed. On continuing the fusion till the mass is become limpid and flows smoothly, and augmenting the heat, towards the end of the operation, to a gentle redness, the subsulphate of potassa formed will be decomposed again, and on boiling the mass with alcohol a perfectly colorless solution will be obtained, from which the sulphocyanide of potassium will crystallise in perfectly colorless prisms. The watery solution of the crude mass is free from carbonate of potassa, sulphuret of potassium, and mellonide of potassium; and contains, besides the sulphocyanide of potassium, only sulphate of potassa. The iron separates with facility from the liquid, as fine scales of pyrites. By this method we obtain of the sulphocyanide of potassium one-third more than by the usual one. This is the simplest and most advantageous process of preparing the sulphocyanide of potassium that I ever knew.

The mellonide of potassium which was obtained by one of the aforesaid methods is, after having been washed with alcohol, free from sulphocyanide of potassium, but seldom entirely pure, it generally presents a yel-

lowish color, and contains a small quantity of a peculiar combination of potassium and sulphur, which I did not more fully examine; they may, however, easily be separated, for the mellonide of potassium* dissolved in water, on being treated by acetic acid, experiences no change, whereas the same acid, from the aforesaid combination of potassium, throws down a gelatinous or flaky precipitate. To separate them, the impure mellonide of potassium is to be dissolved in hot (not boiling) water, acetic acid is added so long as it throws down a precipitate; this precipitate, by means of a filter is separated from the liquid, to which, to render it slightly alkaline, a little carbonate of potassa is added, and we allow it to crystallise. To obtain the whole of the mellonide of potassium crystallised requires a longer time; a moderately concentrated hot solution, in which, on cooling after two or three hours, a moderate deposition of some crystals is noticed, frequently over night becomes a dense pulpy mass, which is no longer liquid, and offers fine needles.

If after this second crystallisation the mellonide of potassium is still colored, it is to be dissolved again, treated with a few drops of acetic acid, and, on adding a sufficient quantity of charred blood, it is boiled and then filtered, by which means the liquid is rendered colorless, and on cooling pure white crystals of mellonide of potassium are obtained.* Previous to describing the properties of the combinations of the mellonides, I will relate the experiments made to ascertain the constitution of mellon: to arrive at this end, I made use of the mellonide of silver, the mellonide of lead, and the mellonide of mercury; combinations easily obtained by the mutual decomposition of mellonide of potassium and a solution of a salt of silver of lead, or of corrosive sublimate.

If the formation of mellonide of potassium is attentively considered, we find, *a priori*, that in the formation of the combinations of mellon neither oxygen nor hydrogen enter as constituent parts, for mellonide of potassium is produced under circumstances which exclude the co-operation of these elements.

At the period of the fusion of ferrocyanide of potassium with the sulphur, in which the formation of the sulphocyanide of iron begins, the fused mass can no longer contain any of the hydrogen, the mellon formed by the transformation of the sulphocyanide of iron combines with the potassium of the sulphocyanide of potassium; in the fused mass the mellonide of potassium can only be supposed to exist in the anhydrous state. It seemed to be admissible, that the anhydrous mellonide of potassium could only exist in this mixture with sulphocyanide of potassium, that it crystallises from a watery solution, that with a certain amount of water it combines so intimately as to be inseparable, making part of the constitution of the crystallised salt.

We might be induced to adopt this view, by L. Gmelin's analysis of the mellonide of lead, which at 266° F. still retains some of water, the elements of which are sufficient to form, with the oxide of lead and with the mellon, mellonide of hydrogen. But it now appears that we are not warranted in establishing an analogy between the constitution of this combination of lead and that of any other metal: mellonide of potassium, for instance, and mellonide of silver may be obtained in an anhydrous state. To ascertain the relative proportions of nitrogen and carbon contained in mellon, dried mellonide of lead was burned with oxide of copper, and the mixture of gases obtained was analysed in the usual manner, with a solution of caustic potash ley. The last portions of gas in 5 volumes, contained 3 volumes carbonic acid and 2 volumes nitrogen, the same proportions which L. Gmelin already ascertained.

In another experiment dry mellonide of mercury, in an ordinary combustion tube, was heated to redness, the disengaged mixture of gases collected over mercury, and treated with caustic potassa. By the decomposition of the mercurial combination, there should have resulted mellon and mercury, and by that of the mellon nitrogen and cyanogen, in the proportion of 1·3 volumes; the combination, however, which was taken for mellonide of mercury, yielded, under these circumstances, the same products as the hydromellonic acid. In the beginning of the operation a much larger amount of nitrogen is obtained, and only when drawing to a close the gas is found to consist of a mixture of nitrogen and cyanogen, of which three-fourths are absorbed by potassa: for in the beginning nitrogen and prussic acid are disengaged, and the latter is partly condensed.

After these and the above quoted experiments, the relative proportions of the nitrogen and carbon are established beyond doubt. The mellon contains 1½ equiv. carbon for 1 equiv. nitrogen. On calcining 0·8781 dry mellonide of silver in the air, 0·4647 metallic silver were obtained.

Moreover, 2·191 mellonide of silver yielded 1·363 carbonic acid and 0·031 water; 0·657 gave 0·444 carbonic acid and 0·016 water.

Hence, mellonide of silver consists of:—

		Calculated.	Found.
Mellon	1136·26	46·40	46·97
Silver	1351·61	53·55	53·03
	2514·87	100	100

According to calculation, in 100 parts mellonide of silver we ought to find 18·05 per cent. carbon; in the first experiment were obtained 17·10, in the second 18·54 per cent. carbon. If in the mellonide of silver, the silver had been contained as an oxide, and the mellon as an hydracid, then, instead of 53 per cent. of silver, we could have obtained only 51·4 per cent.

2·191 mellonide of silver (the quantity analysed), in that case would have yielded 89 milligrammes water, whereas in maximo 31 milligrammes were only obtained.

With regard to hydrogen, the analysis of mellonide of potassium afforded no less accurate results: 1·242 grammes fused mellonide of potassium on combustion with chromate of lead yielded 8½ milligrammes water. In a second experiment 0·814 mellonide of potassium gave 0·022 grammes water. If the dry mellonide of potassium would contain 1 equiv. water, or its elements as constitutent parts, then there ought to have been obtained in the first analysis more than 72 milligrammes, and in the second nearly 50 milligrammes of water. The first analysis yielded 1·169 grammes, the second 0·780 grammes of carbonic acid. Out of 1·371 mellonide of potassium were obtained 1·012 fused nitrate of potassa. The mellonide of potassium was precipitated by nitrate of silver, the precipitate filtered off, the excess of silver thrown down by hydrochloric acid, next with nitric acid, repeatedly evaporated to dryness, and the residue fused.

Consequently, the salt of potassa is composed as follows :—

		Calculated.	Found.	
1 atom mellon	{ 6 atoms carbon, 4 atoms nitrogen }	27·52	26·37	25·88
1 atom potassium		29·63	28·51	

The amount of carbon found so nearly approached to that calculated, as on combustion of a combination of potassium might have been expected.

By these experiments, it seems to me that the composition of mellon, and its character as a compound radical resembling cyanogen, are established; and I pass over to the description of its properties and combinations.

MELLON.

The preparation of pure mellon is somewhat difficult. Mellon being decomposed only at a temperature exceeding the boiling point of mercury, it might be inferred that it is easy to obtain it from the mellonide of mercury; but neither its combination corresponding to the suboxide nor that which corresponds to the oxide, can be obtained in a pure state. Mellonide of potassium throws down, from a solution of nitrate of silver, a thick, heavy, flaky precipitate, which on being ignited by itself, yields prussic acid, and on combustion with oxide of copper gives considerable quantities of water; it manifestly contains hydromellonic acid, which is precipitated by the free acid in the mercurial solution. The precipitate, on drying, becomes gray, and on being heated yields metallic mercury, evidently as the sub-mellonide is transformed into mellonide.

If at a low temperature the solution of corrosive sublimate is mixed with mellonide of potassium, a thick, gelatinous precipitate is obtained, which changes its appearance when heated, however gently. The liquid becomes milky, and without becoming clear it by degress throws down a very fine white powder, which, after having been washed, dried, and calcined, yields mellonide of potassium, and finally cyanide of potassium. If the two solutions are mixed when boiling, the mixture remains clear and transparent for some minutes; on cooling it becomes turbid, yielding a precipitate free from potassa, its amount of mercury diminishing on being washed.

The purest mellon which I have obtained was the residue of the distillation of submellonide of mercury, at the period in which ¾ of the volume of the disengaged mixture of nitrogen and cyanogen are absorbed by caustic potassa.

In that condition it exhibits a bright yellow powder, which is light, and colors matters brought into contact with it, being insoluble either in water, alcohol, or any indifferent liquids. Mellon is dissolved by a solution of potassa, disengaging ammonia; the solution contains a salt of potassa which, as well as the changes that mellon undergoes on being treated with nitric acic, by which it is transformed into cyanilic acid I described on a former occasion (*vide* these Annals, vol. x., page 45). On applying heat it dissolves in hydrated sulphuric acid, and is again thrown down by water. Its great affinity for metals, especially for potassium, is remarkable. The solution of mellonide of potassium may be boiled with iodine, without the least decomposition being noticed, the iodine coloring the liquid brown, and is volatilised on evaporation, in such a manner that by somewhat concentrating the liquid, crystallised mellonide of potassium may be reobtained.

Cyanide of potassium, under the same circumstances, dissolves a great quantity of iodine, the liquid becomes colorless, and, solidifying on cooling, it presents a pulpy crystalline mass of cyanide of iodine, which, on being heated, sublimes under the known form of woolly crystals. Hence mellon can-

not be displaced from its combinations by iodine, but it can completely expel the iodine from the iodide of potassium. A mixture of the dry iodide of potassium with mellon fuses, with a vivid disengagement of vapors of iodine, mellonide of potassium resulting.

On passing chlorine gas through a solution of mellonide of potassium, a white mucilaginous precipitate is thrown down, which, on being washed, cannot be entirely freed from chlorine; it may be dissolved in ammonia; when disengaging gases it becomes of a yellow color.

On fusing mellon with hydrate of potassa, ammonia and cyanate of potassa are obtained. The formation of this salt may easily be accounted for, bearing in mind that mellon, with reference to its elements, may be considered as cyanide of nitrogen $Cy^3 + N$. On adding to this formula the elements of 3 atoms of water, we obtain ammonia and cyanic acid.

In all these experiments, with the same results we may employ the mellon left after the so-called sulphocyanogen has been heated and calcined; on treating at a gentle heat, a dry mixture of sea-salt and sulphocyanide of potassium, with anhydrous chlorine gas, we obtain (as has been described more fully in these Annals, vol. x., page 6) the residue having been washed with water, a considerable volume of a bright yellow, lamellar, light substance, which, on being calcined, is freed from chlorine and sulphur, and with regard to all other properties behaves like mellon.

Considering the formation and composition of mellon, it seems not improbable that, under certain circumstances, cyanogen itself, on leaving carbon, may be transformed into mellon; the so-called paracyanogen might easily be a mere mixture of carbon and mellon, or a mellonide of carbon.

The observation of Brown that paracyanogen, after being calcined, loses the whole of its nitrogen, leaving pure carbon, might easily consist in the mellon being volatilised as nitrogen and cyanogen, whereas the carbon being fixed, remains.

At least, the separation of the nitrogen from the carbon is not easily to be accounted for, inasfar as common coal containing nitrogen, even at the highest temperatures, does not part with the latter element. In a work on the determination of the atomic weight of carbon, executed in common with Prof. Redtenbacher, we noticed that dry cyanide of silver on being fused, is suddenly, with phenomena of ignition and vivid disengagement of inflammable gases, decomposed, and that the residue offering a metallic aspect on being dissolved in nitric acid, leaves a dark brown flaky substance. This brown substance, from some later experiments of Thaulow, is a combination of silver with nitrogen and carbon, in the same proportions as they are contained in cyanogen. The experiment being repeated, the brown substance, on combustion with oxide of copper, yielded a mixture of gases, containing carbonic acid and nitrogen in the proportions by volume of 2·1. The combination with silver, after having been repeatedly boiled, then dried and calcined, left in two experiments 43·4 per cent metallic silver, consequently, for every 3 equiv. cyanogen, or its elements, contained one equiv. silver. A mixture of 1 equiv. mellonide of silver, with 2 atoms carbon, would have yielded the same proportion. It seemed to me that by an experiment it would be decided upon the merits of these suppositions. If the so-called paracyanide of silver was a mixture of carburet of silver and mellon, or carbon and mellonide of silver, then on being calcined it ought to give cyanogen and nitrogen, and carburet of silver should remain. With regard to cyanogen and nitrogen, this was, indeed, confirmed by experiment. At a strong red heat, the paracyanide of silver prepared from the cyanide of silver is decomposed, cyanogen and nitrogen are obtained, occupying more than a hundred times the volume of the cyanide employed, though not in the same proportions in which, under the same circumstances, they had been yielded by mellon. The two first tubes contained nitrogen and cyanogen in the proportions of 1·8, five others 1·5, 1·4, 1·8. Mellon would have given nitrogen and cyanogen in the proportion of 1·3. Since it is possible that the paracyanide of silver contains subcyanide of silver, it may be supposed that on disengaging cyanogen from this the proportion of cyanogen would be augmented. This subject is by all means deserving a further consideration, and the fact that in the combination of silver the paracyanogen at a red heat passes over again into cyanogen, and that part of it is decomposed into nitrogen and carbon, is still interesting. The cyanide or paracyanide of silver by themselves, under these circumstances, had yielded no nitrogen. The gas disengaged the moment cyanide of silver passes over into the paracyanide of silver, which Thaulow considered to be different from common cyanogen, exhibited no properties justifying such an assertion. Potassium, on being burned in it, becomes cyanide of potassium.

The cyanate of silver on being heated in a perfectly dry state, exhibits phenomena of ignition like those obtained with cyanide of silver, much gas is disengaged with some vehemence; and if, as is probable, the decom-

position takes place in the same manner as in the case of the corresponding combination of sulphur, the nitrogen and carbonic acid obtained ought to be in the proportion of 1·3, and in the residue mellonide of silver should remain. On that likewise I made some experiments. Cyanate of silver heated by itself, yields a mixture of gases, which in the six last tubes as a mean, contained 10 vols. nitrogen for every 22 vols. carbonic acid; the cyanogen by itself, would have furnished for every 10 vols. nitrogen 20 vols. carbonic acid; hence, a certain quantity of nitrogen was manifestly left in the residue. On combustion of this residue with oxide of copper in the last nine tubes of the obtained mixture of gases, for every 100 vols. nitrogen, 137 vols. carbonic acid were found: mellonide of silver under the same circumstances would have given 150 vols. carbonic acid for the same quantity of nitrogen.

HYDROMELLONIC ACID.

If a boiling solution of mellonide of ammonium or mellonide of potassium, is mixed with nitric or muriatic acid, the liquid remains for some seconds clear, shortly after becoming turbid by a little concentration, thickening to a pure white pulp of hydromellonic acid; from a diluted solution it is precipitated by mineral acids in the form of white flakes. The statement of L. Gmelin that hydromellonic acid is precipitated by acetic acid, is true with reference to the crude impure mellonide of potassium, and especially to a combination containing sulphur (perhaps hydro-sulphomellonic acid?) which is mixed with it, and may be separated by frequent crystallisations.

The hydromellonic acid in its dry state is white, coloring like chalk, very sparingly soluble in cold water, but somewhat more so in boiling water; the solution strongly reddens litmus paper; it is insoluble in alcohol, ether, fat, or volatile oils. It is to be ranked among the stronger acids, as it expels several organic acids from the salts which they constitute with potassa. In hot acetate of potassa it is dissolved with the same facility as in caustic, or carbonate of potassa, and this solution on cooling, turns into a pulpy mass of crystals of mellonide of potassium. Mixed with iodide of potassium in a dry state, on being heated it expels hydroiodic acid and iodine. Heated by itself it is at first resolved into nitrogen and hydrocyanic acid, becoming afterwards yellow, yielding cyanogen, which may easily be known by its purple flame. The hydromellonic acid, which to all appearance seems to be the purest, on being calcined in the air leaves traces of cyanide of potassium and of cyanate of potassa.

To ascertain whether hydromellonic acid which has been dried at 212° F., be anhydrous, or contains water in chemical combination, it was burned with oxide of copper, and the proportion of water and carbonic acid thus obtained determined.

If hydromellonic acid, for 6 equiv. of carbon, contain 1 equiv. of hydrogen, then for every 100 parts carbonic acid, on combustion, ought to produce 21·66 water; and if it be a hydrate of one atom, 43·32 water should be the result.

By experiment were obtained:—

I. For 100 carbonic acid, 19·62 water.
II. For ditto ditto 27·27 ditto.

Mean for 100 for carbonic acid 23·44.

From this it appears, that this acid in its dry state, as might have been anticipated, is not hydrated.

Though hydromellonic acid, on being treated with mineral acids, seems in the first instance to experience no change, if, however, under the influence of heat their action is protracted, it is completely decomposed. If to a thin pulp of freshly-precipitated hydromellonic acid, muriatic or nitric acid is added, taking care that the mixture be kept boiling; after 3 or 4 hours the whole is dissolved, a clear liquid is obtained, which, on cooling, does not become turbid, and deposits no hydromellonic acid. The acid liquid on being evaporated to dryness, and maintained at an appropriate temperature until the free acid is separated, a white residue is obtained, which, on being placed in water gives sal-ammoniac. Mr. Chodnew is at present investigating the products of this decomposition, the results of which will be communicated by him in an early number of these "Annals."

MELLONIDE OF POTASSIUM.

The preparation of mellonide of potassium has been fully explained in page 437. A hot solution, on being allowed slowly to cool, crystallises in fine, concentrically-grouped, colorless, transparent needles, under the microscope, solidifying as a pulpy mass of crystals, which contain water of crystallisation. These are insoluble in alcohol, and if alcohol be added to their solution in water, it instantly becomes turbid, depositing crystals on being allowed to stand. From a boiling mixture of equal parts of alcohol and water, mellonide of potassium crystallises exceedingly beautiful. In the air mellonide of potassium effloresces, the silky needles formed become white, and are without lustre. At 248° it loses $\frac{4}{5}$ water of crystallisation, dried to fusion, or 302° it is anhydrous. It possesses a bitter taste.

1·7355 crystallised mellonide of potassium on fusion lost 0·441 water, or 25·41 per cent. Consequently the crystallised salt consists of

		calculated.	found.
1 atom mellonide of potassium ..	1653·18		
5 do. water ..	562·5	25·38	25·41

The salt being dried at a temperature of 248°—302°, the last atom of water disappears, causing a feeble swelling. The fused salt presents a yellow dense fluid, solidifying on cooling into an opaque, crystalline mass, which is greatly contracted in such a manner as to form cavities, which are filled with needles.

The mellonide of potassium, on being heated in close vessels above its melting point, disengages nitrogen and cyanogen, cyanide of potassium being left.

Fused in the air the mellonide of potassium is oxidised with great facility; two products chiefly are formed; the one is cyanate of potassa, and the other a salt of potassa, which is far less soluble.

Platinum vessels are powerfully attacked by fused mellonide of potassium.

MELLONIDE OF SODIUM.

This combination is best obtained by treating mellonide of barium with carbonate of soda; it crystallises in hydrated white needles of a silky lustre, which are insoluble in alcohol, but soluble in water to some extent.

MELLONIDE OF AMMONIUM.

This salt is obtained, in a state of great purity, by the decomposition of carbonate of ammonia with mellonide of barium; by its external appearance it is not to be distinguished from mellonide of potassium, it contains water of crystallisation which at a higher temperature is expelled. The dry salt exposed to a higher temperature loses ammonia, the residue becomes yellow, furnishing products similar to those formed by hydromellonic acid; it is insoluble in alcohol.

MELLONIDE OF BARIUM.

On adding mellonide of potassium to a solution of chloride of barium, a dense white precipitate, entirely soluble in water, is obtained. On cooling the saturated solution, mellonide of barium crystallises in transparent short needles containing six equivalents of water, five equivalents (20·87 per cent.) disappearing at 266°.

MELLONIDE OF STRONTIUM

Is obtained in the same manner as the mellonide of barium, from which it differs only by its greater solubility in water. Its saturated boiling solution solidifies into a pulp of fine needles.

MELLONIDE OF CALCIUM.

On decomposing mellonide of potassium by chloride of calcium, a dense white precipitate is obtained, which, when hot, is still more soluble than mellonide of strontium, and is as easily crystallisable. These crystals contain four equivalents of water, three atoms of which 18·05 per cent. escape at 248° F.

MELLONIDE OF MAGNESIUM.

This combination is still more soluble than the salt of calcium. A solution of Epsom salts may be mixed with a solution of mellonide of potassium without in the first instance producing a precipitate, but on allowing it to stand for some time, mellonide of magnesium is separated as fine white felty needles.

The four salts above described are remarkable for their insolubility in liquids containing salts; they are much more soluble in pure water than in water containing a salt of baryta, strontia, lime, or magnesia. This becomes particularly striking when one of these salts, on being dissolved in pure water and saturated at a common temperature, as, for instance, the salt of baryta, is treated with a solution of chloride of barium, or the salt of strontia with chloride of strontium, &c., a copious crystalline precipitate is instantly produced, which is mellonide of barium, or respectively mellonide of strontium, &c.

MELLONIDE OF COPPER.

It is obtained by treating sulphate of copper with mellonide of potassium, presenting a fine parrot-green precipitate, which is sparingly soluble in boiling water. 100 parts of this salt, dried at 95° F. yield, on combustion with oxide of copper, 23·94 per cent. water; the salt, therefore, contains altogether five atoms of water, which correspond to 22·23 per cent. Heated to 248° F., on becoming black it loses $\frac{4}{5}$ of its water.

Mellonide of potassium precipitates the following salts:—

Sulphate of manganese as a *white gelatinous mass;* chloride of copper of a *bright yellow;* the salts of cobalt of a *peach-flower red;* the salts of peroxide of iron of a *dark yellow;* the salts of protoxide of iron of a *white with a greenish tint;* the salts of chrome of a *green;* and tartar emetic of a *white* color; these precipitates are difficultly soluble in water.

MELLONIDE OF SILVER.

Is a white gelatinous precipitate which is anhydrous at 248° F.

Combinations of mellon with chlorine, oxygen, &c., require further investigation.

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ON THE PRETENDED PRODUCTION OF VALERIANIC ACID FROM INDIGO, AND ON THE ACID RESULTING FROM THE FUSION OF HYDRATE OF POTASSA WITH LYCOPODIUM.

BY DR. JAMES SHERIDAN MUSPRATT, OF LIVERPOOL.

It is always of great interest and real value to science to examine, step by step, the manifold transformations which organic matters, on being acted upon by other bodies, undergo; but it is most particularly worthy our attention, if by such metamorphoses combinations arise, which, until then, we were in the habit of considering as the immediate products of the vital process.

To the bodies, in the artificial formation of which, in the manner stated, chemists have succeeded, belongs valerianic acid. This acid, which is found ready formed in the root of *Valeriana officinalis*, and which was lately discovered by Winkler* as a constituent of athamantin, a remarkable crystalline body, extracted from the root of *Athamantina oreoselinum*, was some years ago obtained by Dumas and Stass† as the product of oxidation of the fousel oil (hydrated oxide of amyl), to which it relates in the same manner as acetic acid does to alcohol.

$\underbrace{C^4H^5O}+aq.$ $\underbrace{C^4H^3O^2O}+aq.$

Alcohol. Acetic acid.

$\underbrace{C^{10}H^{11}O}+aq.$ $\underbrace{C^{10}H^9O^2O}+aq.$

Fousel oil. Valerianic acid.

The said chemists, on treating the fousel oil by a mixture of lime and hydrate of potassa, at a temperature of 338° F., so long as hydrogen was disengaged, obtained valerianic acid. Some time after, Cahours‡ showed that the same acid is formed when vapors of fousel oil, in the presence of platinum black, are brought into contact with oxygen, an assertion which, by experiments made in the laboratory of Giessen, was corroborated.

The interesting experiment of Dumas and Stass, on the formation of valerianic acid from oil of potatoes, was soon followed by a discovery of a new method of preparing this acid, which excited much attention.

M. Dumas§ communicated to the Academy of Sciences at Paris a note from M. Ch. Gerhardt, by which it appeared that this atter chemist, on treating indigo with hydrate of potassa, produced valerianic acid.

According to the directions of M. Gerhardt, the indigo, cut into small pieces, is to be put into fused hydrate of potassa, in which it is dissolved, becoming yellow, and largely disengaging ammonia and hydrogen. On fusion, a mixture of carbonate of potassa and valerianate of potassa is obtained, from which, by distilling with dilute sulphuric acid, valerianic acid is separated. This method of preparation is stated to be highly advantageous, as Gerhardt obtained, in the course of an hour, considerable quantities of valerianic acid.

According to Gerhardt, the transformation of indigo into valerianic acid may be expressed by the following equation:—

$$\underbrace{C^{16}H^5NO^2}_{\text{Indigo.}}+14\,HO=$$

$$\underbrace{C^{10}H^9O^3,HO}_{\text{Hydrated valerianic acid.}}+6\,CO^2+NH^3+6\,H.$$

The carbon of the indigo is then divided, and, forming partly valerianic acid and partly carbonic acid, it combines with the potassa. The carbonic acid is formed at the expense of the water, one portion of the hydrogen of which, with the nitrogen, produces ammonia; the other portion of the same gas escapes in the reaction. This transformation, however, which in the above equation is so easily developed on paper, does not proceed with the same facility in the crucible.

On communicating Gerhardt's method in the *Annal. der Chemie und Pharmacie*, Prof. Liebig observed, at the same time, that in his laboratory the new process of obtaining valerianic acid from indigo-blue was not confirmed.

Dr. F. L. Winkler* afterwards communicated some experiments on this subject. He observed in his essay, that the phenomena which, on treating hydrate of potassa with indigo, presented themselves, had a striking resemblance to those which, on treating lycopodium with the same body, he noticed on a previous occasion. He therefore repeated his former experiments, when this resemblance was completely corroborated. After a full description of his method of preparing the volatile acid from indigo, which is identical with that stated above, Winkler says that, on decomposing the indigo, ammonia is disengaged, and on dissolving the residue in an acid, a most unpleasant odor is perceived, reminding us of that of the indigo solution,

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* *Buchner's Repertorium*, vol. xxvii., p. 119.

† *Annalen der Chemie*, etc., vol. xxxv., p. 143.

‡ *Idid.*, vol. xxxv., p. 312.

§ *Compt. Rend.*, 1841, p. 262, and *Annalen der Chemie und Pharmacie*, vol. xl., p. 313.

* *Buchner's Repertorium*, vol. xxviii., p. 70.

from which the distilled liquid itself was not free. This distilled liquid, having a strong acid reaction, was neutralised with hydrate of lime, filtered, and, on evaporation in a water-bath, the salt of lime obtained was decomposed by double its weight of strong phosphoric acid. The acid obtained in that way was rather concentrated, and its odor was strikingly similar to that of valerianic acid, though, in addition to that, another unpleasant odor was observed. Winkler then describes the extraction of the acid from lycopodium, remarking that, on supersaturating the residue by sulphuric acid, no solid substance is separated, as in the case of indigo, but an oily combination of a yellow color, and that its solution is of a much more disagreeable odor than that obtained with indigo. He moreover states, that the salt of baryta obtained with acids extracted from indigo or lycopodium are of an astringent saline taste, and that they, on the addition of nitrate of silver, throw down no precipitate; but after some time the solution of silver is decomposed, and silver is deposited. On the salt of baryta being boiled with nitrate of silver, a reaction is induced by the silver, precisely similar to that which takes place on boiling formiate of baryta with a salt of silver.

The following are the conclusions which Winkler draws from his experiments:—The acids obtained by treating indigo or lycopodium by hydrate of potassa, and which must be considered as identical, are not valerianic acid, but most probably not different from formic acid. The fact, however, that the salt of baryta of this acid, on being decomposed by sulphuric acid, yields the odor peculiar to valerianic acid, is still worthy of notice.

The experiments of Winkler throw no light on this subject; the question remains as undecided as it was before. Had this intelligent chemist analysed the salt produced, the real nature of the acids obtained on treating indigo or lycopodium by hydrate of potassa, would not have escaped his notice. The properties to be ascertained by the exterior senses, by that of the taste and smell, lead but too easily into mistakes of all kinds; in such a case it is elementary analysis alone that can decide.

In some remarks on the communication of Winkler's experiments, Professor Erdmann* mentions, that he himself had likewise repeated Gerhardt's experiments, but merely obtained traces of valerianic acid. He hence concludes that valerianic acid can be produced only under certain circumstances, which in the case of Winkler's experiments and that of his own cannot have taken place; and that for the same reason, Fritsche, in his extensive investigations on the action of hydrate of potassa on indigo, obtained no valerianic acid. In conclusion, he adds that Gerhardt is at present occupied with a minute investigation of valerianic acid, advising us to suspend giving an opinion on his discovery until the communication of the treatise on the subject in question, in which he certainly will mention the circumstances under which valerianic acid may be extracted from indigo.

This treatise* is now published, but though M. Gerhardt dwells greatly on the formation of valerianic acid from oil of valerian, and even communicates an analysis of the salt of silver of the acid thus prepared, however, we are not informed of the details concerning the formation of this acid from indigo.

To bring this matter to a final decision, therefore, I was requested by my honored master, Professor Liebig, to make new experiments on this matter, and especially to subject the acid thus formed to an elementary analysis.

Previous to describing my experiments, may I be allowed to premise some remarks. Gerhardt did not state whether, in his experiments, he made use of pure indigo blue, or of that of commerce, which, as is known, contains a great many impurities. According to his equation, however, the valerianic acid is the principal product, and is directly produced from indigo blue.

If, however, the indisputable data on the action of potassa on indigo, now before us, are more attentively considered, then from theoretical reasons alone, the formation of valerianic acid will appear to be highly problematical.

The action of potassa on indigo is a real process of oxidation. According to the duration of this action and the state of concentration of the potassa, various products are formed, a greater or less number of equivalents of carbon being oxidised at the expense of the water, the hydrogen of which partly escapes and partly enters into new combinations. Anthranilic acid is formed first—

$$\underbrace{C^{16}H^5NO^2}_{\text{Indigo.}} + 6HO = \underbrace{C^{14}H^7NO^4}_{\text{Anthranilic acid.}} + 2CO^2 + 4H$$

And by prolonging the action it is resolved into carbonic acid and anilin (krystallin)—

* Erdmann's *Journ. für Prakt. Chemie*, vol. xxvii., p. 250.

* *Annalen der Chemie und Pharmacie*, vol. xl.

$$\underbrace{C^{14}H^{7}NO^{4}}_{\text{Anthranilic acid.}} = 2CO^{2} + \underbrace{C^{12}H^{7}N}_{\text{Anilin.}}$$

By the disengagement of the anilin, however, the whole amount of carbon, which might have served for the formation of the valerianic acid, is removed from the sphere of action of the potassa.

Considerations such as the preceding, induced me to consider the production of valerianic acid from indigo to be highly improbable.

In my experiments, I first studied the action of potassa on pure indigo. Pure indigo (for which I was indebted to the kindness of Professor Liebig) was heated with hydrate of potassa, in a silver capsule, until a portion of it, on being treated with water and acids, showed that the coloring matter was entirely decomposed. To the residue was now added a trifling excess of sulphuric acid. A vivid effervescence of carbonic acid followed, yielding an odor *sui generis*, reminding us of that of fresh *cowhair*. The liquid was then filtered from that which, on the addition of the acid, separated (Chrysalinic acid? Anthralinic acid, &c.) and distilled. I obtained a clear liquid, which, yielding the above-mentioned odor, was of an acid reaction. The liquid was now treated with pure carbonate of baryta; the mixture boiled, filtered, and evaporated to dryness in a water-bath. The yellow residue was of a glassy appearance. On being touched it felt like gum, after a few seconds leaving on the tongue a very unpleasant bitter taste. A portion of it, on being treated by sulphuric acid, disengaged a strong odor of acetic acid, which, however, moreover presented the collateral odor described by Winkler. I obtained about 0·400 grs. of this salt from one ounce of indigo.

To obtain the quantity of this salt requisite for analysis, I treated about half-a-pound of indigo by potassa, in the manner described, decomposed the residue by sulphuric acid, and subjected the filtered liquid to distillation. The distilled substance was boiled with carbonate of baryta, and the salt of baryta obtained evaporated to dryness in a water-bath. To obtain the pure acid, this salt was next distilled with concentrated phosphoric acid. The liquid distilled over was of an acid reaction in the highest degree, and yielded an odor like that of acetic acid. I now mixed the greatest part of it with carbonate of baryta, and allowed the liquid to stand for 24 hours. It was then boiled, filtered, and concentrated in a water-bath. After two days I obtained from the solution a white salt possessing a lustre, crystallised in oblique rhombic prisms; this I carefully pressed between blotting paper, reduced to powder, and dried during three days in a water-bath. I thus obtained 5·84 grms. of the salt.

On this salt being boiled with alcohol and sulphuric acid, acetic ether was manifestly perceptible. On being heated with arsenious acid in a dry state, in an eprouvette, it disengaged the horrible odor of alcarsin (oxide of kakodyl). The solution of the salt, on being treated with nitrate of mercury, threw down a white granular precipitate. Nitrate of silver occasioned a considerable flaky precipitate, which, in the first instance, was of a pure white, but afterwards became reddish, and, on being heated, turned black.

The remaining quantity of the acid was employed for the preparation of the salt of silver. With this intention, at first, a few drops of ammonia were added to the liquid, and next, avoiding excess, precipitated by nitrate of silver. The filtered precipitate was washed with a mixture of alcohol and water—it being less soluble in that mixture—protected against light, and evaporated in a water-bath.

ANALYSIS OF THE SALT OF BARYTA.

I. 0·2405 grammes salt, heated to redness, gave 0·1885 grammes carbonate of baryta = 0·1464 baryta.

II. 0·7790 grammes salt, treated with concentrated sulphuric acid, gave 0·7360 grammes sulphate of baryta = 0·4830 grammes baryta.

For the following determinations, III and IV, I am indebted to the kindness of my friend Mr. C. F. O. Glassford.

III. 0·5585 grammes salt, heated to redness, yielded 0·4225 grammes carbonate of baryta = 0·3436 grammes baryta.

IV. 0·4425 grammes carbonate of baryta, on being treated with sulphuric acid, yielded 0·4970 grammes sulphate of baryta = 0·3261 grammes baryta.

V. 0·7699 grammes salt, dissolved in water, and precipitated by sulphuric acid, yielded 0·7140 sulphate of baryta = 0·4688 grammes baryta.

These numbers correspond to the following per cent.:—

	I.	II.	III.	IV.	V.
Baryta	60·860	62·000	61·52	58·45	60·85
Acid	39·140	38·000	38·48	41·55	39.15
	100·000	100·000	100·00	100.00	100·00

	Mean by experiment.	Theoretically.
Baryta	60·736	60·016
Acid	39·264	39·984
	100·000	100·000

And to the acid the following atomic weights :—

I.	II.	III.	IV.	V.
615·40	586·46	598·63	678·50	615·64

Mean by experiment.	Theoretically.
618·03	643·19

ANALYSIS OF THE SALT OF SILVER.

0·2195 grammes salt, on calcination, left 0·1445 grammes of silver = 0·15519 grammes oxide of silver.

These numbers correspond to the following per cent. :—

	Experiment.	Theory.
Oxide of silver	70·70	69·48
Acid	29·30	30·52
	100·00	100·00

and the following atomic weights to the acid :—

Experiment.	Theory.
601·62	643·19

COMBUSTION OF THE SALT OF BARYTA.

0·501 grammes salt, on combustion with chromate of lead, yielded 0·341 grammes of carbonic acid, and 0·112 grammes of water.

To these numbers correspond the per centage given in the following table, in which, with reference to the amount of baryta, from the above various determinations, a mean was taken :—

		Theory.		Experiment.
4 equiv.	carbon	300·000	18·816	18·562
3 ,,	hydrogen	37·500	2·352	2·483
3 ,,	oxygen	300·000	18·816	18·219
1 ,,	baryta	956·880	60·016	60·736
		1594·380	100·000	100·000

Formula $C^4 H^3 O^3 + BaO$

I will now communicate some experiments which, on this occasion, I made with lycopodium.*

About two ounces of this substance, in the same way in which I proceeded with the indigo, I treated with potassa. On the decomposition of the residue by sulphuric acid, a dark brown matter, exhaling an odor similar to that of sour milk, was separated. The liquid was filtered from this body and distilled. The distilled liquid, as in the former instance, was mixed with carbonate of baryta, boiled, filtered and evaporated in a water-bath. The salt of baryta, prepared in that way, possessed all the properties of that obtained from indigo, but its quantity was not sufficient to serve for an analysis.

Therefore, on operating the second time, I took a larger quantity of lycopodium, heating it with potassa until, on treating it with a mineral acid, a solid body was no longer separated. I then supersaturated the whole residue by sulphuric acid, when a dark yellow-brown oil* was separated, exhaling a very strong smell, resembling that of excrement; the same odor was possessed by the liquid, probably from traces of the oil dissolved in the sulphuric acid. The filtered liquid was now distilled, it exhaled the same odor, and was of a very acid reaction. I now, in the manner often described above, prepared a salt of baryta, which, mixing it with that obtained before, I distilled with phosphoric acid. The result of the distillation was a powerful acid reaction decomposing the soluble carbonates with effervescence. With this concentrated acid,

* I found that lycopodium, on being treated with ether and alcohol, imparted a yellow color to these liquids, which, on filtration and evaporation, yield a dark oil, of a nauseous odor. I have not yet further investigated it.

* The ethereal solution of this body on being filtered through animal charcoal, loses neither color nor odor. It is dissolved in weak potash ley, and, on being treated with common salt, it yields a soap of soda. In mineral acids it is but little soluble. The ethereal solution of the oil, on evaporation, leaves a residue, which, viewed by the microscope, presents a crystalline appearance.

I prepared a salt of baryta and a salt of silver. They resembled the salts obtained from indigo, but on recrystallisation I could not succeed in freeing them from their peculiar odor. Half a pound of lycopodium yielded 5·3 grammes salt of baryta, and 3·12 grammes salt of silver.

ANALYSIS OF THE SALT OF BARYTA.

I. 0·4240 grammes salt, on calcination, gave 0·3119 grammes carbonate of baryta = 0·2422 grammes baryta.

II. 0·4080 grammes salt, on being heated with concentrated sulphuric acid, gave 0·3600 sulphate of baryta = 0·2362 grammes baryta.

III. 0·3480 grammes salt, on combination, yielded 0·258 grammes carbonate of baryta = 0·2003 grammes baryta.

IV. 0·732 grammes salt, on being heated with sulphuric acid, yielded 0·6670 grammes sulphate of baryta = 0·4309 baryta.

To these numbers correspond the following per cent. :—

	I.	II.	III.	IV.
Baryta	57·122	57.892	57·56	58·83
Acid	42·878	42·10S	42·44	41·17
	100·000	100·000	100·00	100·00

Mean by experiment.	Theory.
57·850	60·016
42·150	39·984
100·000	100·000

To the acid corresponds the following atomic weights :—

I.	II.	III.	IV.
718·25	695·97	705·59	670·15

Mean of the experiment.	Theory.
697·49	643.189

ANALYSIS OF THE SALT OF SILVER.

0·356 grammes of the salt of silver, on being dissolved in water, and precipitated by hydrochloric acid, yielded 0·3010 grammes chloride of silver = 0·2435 oxide of silver.

	Experiment.	Theory.
Oxide of silver ..	68·400	69·390
Acid	31·600	30·610
	100·000	100·000

Atomic weight of the acid.

Experiment.	Theory.
670·640	643·189

COMBUSTION OF THE SALT OF BARYTA.

0·4498 grammes salt, on combustion with chromate of lead, yielded 0·314 grammes carbonic acid and 0·133 grammes water.

TABLE OF PER CENTAGE.

4 equiv. carbon	300·000	18·816	19·040
3 ,, hydrogen	37·500	2·352	3·280
3 ,, oxygen	300·000	18·816	19·830
1 ,, baryta	956·880	60·016	57·850
	1594·380	100·000	100·000

Formula $C^4 H^3 O^3 + Ba O$.

From the above experiments we may draw the following conclusions :—

The acid produced on treating indigo or lycopodium, by hydrate of potassa, is nothing but acetic acid.

The acetic acid obtained on treating indigo with hydrate of potassa, seems to be formed from foreign substances, which are accidentally mixed with the indigo blue. The reduced indigo which, however, was not absolutely pure, gave, indeed, a much smaller quantity of acetic acid than the indigo of commerce.

Finally, the valerianic acid obtained by Gerhardt—for the fact, with an eminent chemist like him, admits of no doubt—must be derived from a foreign substance, present in the indigo employed by himself.

I cannot conclude this notice without expressing my thanks to Dr. A. W. Hofmann, for the kind readiness with which at all times he has assisted me in my experiments.

—nt—

ON THE BILE.

BY DR. E. A. PLATNER.*

The concordant results obtained by Messrs. Kemp, Theyer and Schlosser in analysing the bile, leave scarcely any doubt that the bile is a substance of a constant composition, and that soda forms an integrant part of it. I have been so happy as to discover a fact,

* *Annalen der Chemie und Pharmacie*, July, 1844.

which seems calculated to remove every doubt on that score.

In the month of February I already communicated to Prof. Müller, of Berlin, that I obtained the bile in a crystalline state; but on finding, afterwards, that the ether employed for the preparation contained a body identical with Gmelin's resin of bile, I was obliged to believe that two entirely different substances enter into the composition of the bile, one of which contains all the nitrogen, and the other all the carbon, hydrogen, and oxygen of the bile. By the kindness of Prof. Liebig, however, I have been better informed, and I must now consider my original views as the true ones. I will now relate the different methods by which I have repeatedly succeeded in obtaining bile in a crystallised state.

Fresh ox-bile is evaporated in a water-bath, as nearly as possible to dryness, then exhausted by alcohol and filtered; the filtered solution is afterwards decolored by charcoal, or, if this be not done in a manner to be explained in the sequel, by the protoxide of tin, or it is not decolored at all. The result was still the same; a new proof that the coloring matter does not constitute an essential part of the composition of the bile. The decolored or not decolored solution of bile, is allowed to stand for some days, when some mucus is still separated. The liquid is then filtered again, and examined by absolute alcohol, and if this latter body render it turbid, its quantity must be augmented and filtered again. The way of proceeding is now again various. We either pass through the liquid a stream of hydrochloric acid until it becomes of a slightly acid reaction, or an alcoholic solution of oxalic acid is added so long as it throws down a precipitate. I once employed a watery solution of oxalic acid, and the result was quite the same. The precipitate obtained was filtered, and hydrochloric acid was employed, which was removed by digestion with oxide of lead; if, however, oxalic acid was made use of, the excess was removed by carbonate of lead. If it is intended to decolor, and at the same time to collect separately the coloring matter, then to the liquid, treated first by oxalic acid, and next by carbonate of lead, after having diluted it with $\frac{1}{4}$ water, we add some protoxide of tin, and constantly stirring, heat it till it boils. The coloring matter combining with the tin is precipitated, and the liquid becomes yellow; after the whole of the coloring matter is thrown down, the liquid is to be filtered from the precipitate. The bright green precipitate, and in some places colorless, remaining on the filter, is to be washed with water put into a bottle containing alcohol, mixed with a few drops of sulphuric acid, and shaken until the whole of the coloring matter be extracted, and the precipitate becomes perfectly white. It is then to be filtered, and to the fine green liquid which passed through, much water is added, and it is allowed to stand. The coloring matter was then separated in flakes. To collect these, the vessel is gently heated. The coloring matter is rather firmly adherent to the inner sides of the vessel, and the supernatant liquid may be poured off. To separate the flakes of the coloring matter by filtration, is a slow process; for the filter very soon becomes obstructed, and the liquid ceases to pass through it. The collected coloring matter is repeatedly washed with water, dried in the air, and, by absolute ether, freed from fat. It now represents a green resinous mass, easily reduced to a state of powder, insoluble in water, but easily soluble in alcohol. It dissolves with difficulty in ether, and the more so the less alcohol is contained in the ether. It has no odor, and is of a bitterish taste. Insoluble in muriatic and sulphuric acids, easily soluble in potassa and ammonia, the green color being transformed into yellow. On applying heat, the same change of color takes place. Heated with potassa, ammonia is disengaged. If this is not furnished by another substance, the coloring matter of the bile cannot be identical with chlorophylle as is thought by Berzelius.

The bile filtered from the precipitates, be it decolored or not, is freed from the metals dissolved in it, as lead or tin, by a stream of sulphuretted hydrogen passed through it; it is filtered again, and allowed to stand for some time, the solution diluted with water, and when, for the most part, choloidinic acid is separated, which is to be attributed to part of the bile being decomposed; hence at the same time some taurin was produced. The solution of the bile is removed from the choloidinic acid and evaporated to dryness. This must be done, by continued stirring towards the end of the operation. The liquid does not solidify when hot, but ought not to be removed from the water-bath before it can be drawn by a glass rod into readily solidifying and brittle long threads. The evaporating capsule is then cooled, and the mass contained therein is reduced to powder, before it can attract humidity. This powder is now dissolved in water with a milky appearance, which is to be attributed to the choloidinic acid combined with undecomposed bile. The powder is afterwards thrown into a phial, and as much absolute alcohol is added as is requisite to dissolve it when hot, which generally amounts to a volume equal to it-

self. A great quantity of ether, from 10—15 volumes is then poured on the solution, and is for some days exposed in a closed vessel to a strong and, if possible, increasing cold. I always took advantage of some cold winter nights, when it froze very hard. In applying artificial cold, many difficulties stand in our way. On the bottom of the vessel, crystals are then formed, which are mixed with a yellow, not crystalline, mass (choloidinic acid). On the inner sides of the vessel and in the ether itself, there appear, moreover, arranged in the form of stars, perfectly colorless white crystalline needles. The most beautiful ones I one day obtained from the ether poured on undecolored bile, after I had given up all hopes of obtaining any from it. Under favorable circumstances the mass crystallising on the bottom perfectly separates from the choloidinic acid. The ether is poured off, the residue dissolved again in spirit of wine, and ether again poured on it. This may be several times repeated. The ether poured off is collected, mixed with absolute ether and again exposed to a low temperature. A greater quantity of crystals is formed. The crystals obtained in that way are entirely pure bile, or, according to Liebig, acid fellinate of soda: they are of a sweetish taste with a bitter aftertaste, very easily soluble in water and alcohol. In the air they instantly deliquesce, and therefore must be only kept in ether or in their mother liquor. Their solution I found to be neutral, but the crystals, on deliquescing in the air, are manifestly of an acid reaction. On the addition, however, of some water, this acid reaction is removed. The solution is not precipitated by sugar of lead, but acetate of lead and nitrate of silver throw down a white precipitate. Muriatic, sulphuric and nitric acids, even when concentrated, do not render it turbid. Professor Liebig, however, found that the crystals which I sent to him were precipitated by sugar of lead, when the acid reaction was previously neutralised. He found, moreover, that the aqueous solution, which, on being treated at a low temperature with muriatic acid, does not become turbid, on being heated was rendered turbid, and deposits oily drops; that, on adding some water, it became whitish, turbid and solid. If the muriatic acid is removed and water then poured on it, the oily body is perfectly dissolved, and may be precipitated again by an addition of muriatic acid. This behaviour characterises the fellinate of soda (pure bile). The solution of the crystals, on being heated with moderately concentrated sulphuric acid, the liquid presented the color and appearance of old bile. After this, Prof. Liebig doubts not for a single moment that I succeeded in obtaining the acid fellinate of soda in a crystallised state.

The ether employed in crystallisation being distilled off a body remains, which, on repeated boiling with water, behaves entirely like Gmelin's resin of the bile. On being dried it becomes brittle, and is easily reduced to powder; on combustion it leaves no ashes. Insoluble in water, but easily soluble in alcohol, from which, by an addition of water, it is precipitated with a milky appearance. The solution strongly reddens litmus paper, expelling carbonic acid from carbonate of ammonia and carbonate of soda; and, combining with this latter substance, it is soluble in water. It is likewise dissolved by caustic potassa, soda and ammonia, but not by carbonate of potassa. With a development of reddish fumes, disengagement of heat and effervescence, it is dissolved by concentrated nitric acid. In this solution salts of lime produce a turbidness; probably oxalic acid was produced. By sulphuric acid, though slowly, with a dark red, or black red color, it is likewise dissolved.

In conclusion, I will make some remarks on the coloring matter of the bile. It is known that bile, on being treated with acids and free access given to the air, in time becomes green; but by nitric acid the change of color is instantaneous. It becomes, at first, green, then blue, violet, and finally yellow. The nitric acid afterwards destroys the coloring matter. According to my experience, however, the mere access of air may in time produce the same change of color; for an alcoholic solution of bile, on being for a longer time exposed to the air, becomes at first green, which, by degrees, is changed into a perfectly red color. These changes of color are undoubtedly produced by a progressive oxidation of the coloring matter. The coloring matter extracted from the bile by Berzelius with baryta contains no nitrogen; but the billinic coloring matter prepared by myself in the manner above stated, contains nitrogen. May this subject, therefore, be recommended for a further investigation.

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ON SOME NATURAL PHOSPHATES AND ARSENIATES OF COPPER.

BY DR. C. B. KUHN.*

The uncertainties which, with regard to phosphates and arseniates, and other substances of a similar nature, are very nume-

* *Annalen der Chemie und Pharmacie*, July, 1844.

rous, have occupied my mind for many years; but the unfavorable circumstances of my civic position prevented me from devoting the necessary trouble and care to experiments requisite for this—on account of its numerous consequences—important subject. Not to lose priority of knowledge, which is generally dated from the moment of publication, by delaying the communication of the facts established, and not to promote the views of those, who, for certain reasons, deny or pretend not to be aware of the many circumstances which, with reference to practical chemistry, render my sphere of action difficult, I preferred to give in the mean time an extract, though the subject will only have its full interest when treated in proper connexion.

The three modifications of phosporic acid, as has certainly been felt by a great many chemists, and actually maintained by some, are not yet ascertained beyond doubt. The investigations of Graham do not go further than the salts of soda, and on that small point it has been ventured to build a large winged edifice; its wavering at the least shock cannot, therefore, surprise — difficulties of the kind proceed from the natural phosphates and arseniates; and, on nearer investigation, a great many originate even from artificial salts. We first detail some analyses which seem to confirm Graham's views.

LIBETHINITE.

Fine emerald-green crystals give with the blowpipe no trace of arsenic, become opaque in the glass-tube, assuming a pistachio, green color. 0·678, on being calcined lost 0·025. On being treated with nitric acid 0·115 remained undissolved; this was motherstone, consisting of quartz, and could, therefore, have contributed nothing to the loss. The boiling solution was treated with an excess of caustic potassa, and after the oxide of copper (0·378) separated, the liquid acidulated by nitric acid, and acetate of lead added; by the precipitate amounting to 0·901 we are to calculate 0·158 phosphoric acid.

A second and still purer portion of mineral, amounting to 0·642, had lost 0·026, left undissolved 0·034, and copper separated by sulphuretted hydrogen, and then oxidated 0·407. Of the remaining liquid the sulphuric acid was separated by nitrate of baryta, and on treating with acetate of lead 1·238 precipitate obtained, which, on the addition of sulphuric acid, gave 1·439 sulphate of lead (=1·059 oxide of lead); hence the phosphoric acid amounts to 0·179.

The results of the two analyses of the libethinite are as follow:—

Cu O	66·55	66·94	4	158·4	66·33
PO^5	28·00	29·44	1	71·4	29·90
HO	4·43	4·05	1	9·0	3·77
	98·98	100·43		238·8	100·00

The formula to be derived from this would be—

$$(3\ Cu\ O + PO^5) + (Cu\ O + HO)$$

PHOSPHATE OF COPPER FROM LIBETHIN.

The mineral is fibrous with concentrically conchoïd fragments, more compact than that of the Voigtland, in its fracture of the lustre of wax, with the appearance of a fused substance. It is endowed with the property, on calcining, of falling to powder, without decrepitation. From this property we might derive the name of the mineral (though its peculiarity does not only consist in that, but likewise in its mixture,) and call it *copperdiaspor*, were it not that this might lead us to mistake it for other bodies. Since, on calcining, the amount of water cannot be well determined—it was tried once, and, notwithstanding all precautions, 9·35 per cent., hence by one half too much, were found. I preferred most carefully to determine the two other constituent parts, and to take the loss as water.

The portion, which on calcining gave 9·35 loss, contains in addition to that 67·00 per cent. oxide of copper, and 24·22 phosphoric acid.

0·975 of the calcined mineral furnished 0·715 oxide of copper, and 1·455 lead precipitate, of which 1·628 sulphate of lead (=1·198 P bO) could be prepared.

1·100 of the uncalcined mineral left, on solution in nitric acid, 0·011 undissolved; on precipitating with caustic potassa I obtained 0·758 oxide of copper, and the precipitate of lead produced afterwards=1·469 gave 1·639 sulphate of lead, of which 1·206261 oxide of lead are found by calculation.

By the two first experiments it is proved, without leaving any doubt, Cu O : PO^5=5 : 1. The last experiment gives the following per cent. and calculation:—

Cu O	69·61	5	198·0	68·89
PO^5	24·13	1	71·4	24·85
HO	6·26	2	18·0	6·26
	100·00		287·4	100·00

The formula hence derived therefore is,—

$$(3\ Cu\ O + PO^5) + 2\ (Cu\ O + HO).$$

PHOSPHOROCHALCITE.

From Rheinbreitenbach; compact, bluish-green; in some cavities of the motherstone

n scarcely discernible crystals, which I could not recognise with the microscope; in some places covered with a dark (brownish?) coating; being changed, on calcining, in the same manner as the libethinite and the phosphorochalcite of Hirschberg.*

1·844, on calcination, lost 0·152 = 8·134 per cent.

0·740 lost, on calcination, 0·062; the sulphuret of copper precipitated by sulphuretted hydrogen from a solution of nitric acid yielded 0·510 oxide of copper; from the remaining liquid, after the separation of the sulphuric acid by baryta, acetate of lead threw down 0·925, of which 0·163 has been calculated to be phosphoric acid.

0·649 picked light green mineral, on calcination, lost 8·95 per cent.; caustic potassa from the nitric solution threw down 0·321 oxide of copper, and of 0·526 of the precipitated salt of lead 0·580 sulphate of lead were produced; hence the phosphoric acid amounted to 0·099.

A portion of another piece, of the same color, but with conchoïdal fragments, similar to that of Hirschberg, though not so manifestly fibrous and rather more dense in the fracture, taken from most carefully selected specimens of 0·889 lost, on calcination, 0·065; on dissolution 0·175 of the gangue remained, which, since 1·583, on calcining, left 1·547, most having been yielded by 0·179 of a fresh gangue; the pure salt of copper, therefore, amounted to 0·0710 and the quantity of its water (the loss on calcination taken for it) to 0·061. The oxide of copper (re-formed by the obtained sulphuret of copper) weighed 0·489; by combining with oxide of lead the phosphoric acid was found to be 0·152.

The result was, therefore,—

Cu O	68·92	68·44	68·87	6	237·6	70·70
PO^5	22·03	21·11	21·41	1	71·4	21·24
HO	8·134	8·38	8·95	8·59	3	27·0	8·06
	99·33	98·50	98·87		336·0	100·00

These analyses, therefore, corroborate that of the mineral of Hirschberg, which has been considered as somewhat doubtful; but the latter was manifestly purer.

Its formula would be,—

$$(3\ Cu\ O + PO^5) + 3\ (Cu\ O + HO).$$

In the calcined residues of these three minerals, if means were given to decide upon whether we had not mere mixtures to deal with, we had ascertained three new modifications of phosphoric acid—

$4\ RO + PO^5$; $5\ RO + PO^5$; $6\ RO + PO^5$

But in fresh minerals the water contained leads to a simple series; the three bodies namely are to be considered as combinations of common phosphoric acid with oxide of copper and 1·2 or 3 hydrated oxide of copper.

EUCHROITE.

Owing to the high price of this substance I could till now make only two analyses, which unfortunately were discrepant to such an extent, as not to enable me to remove the doubts prevailing with regard to the formula of its composition. In one instance I dissolved in nitric acid, and after having removed the copper by an excess of caustic potassa, I precipitated the arsenic acid by acetate of lead. In that way I obtained from 0·958 mineral, 0·450 oxide of copper, and 1·000 precipitate of lead, which yielded 0·029 sulphate of lead; the filter gave 0·029 sulphate of lead. The piece examined lost, on calcination, 0·210.

In the second instance, 0·898 were examined; the mineral was dissolved in muriatic acid, treated with sulphuretted hydrogen, and the sulphuret of copper, as soon as it was completely separated, filtered: from this, and the much later appearance of sulphuret of arsenic, the oxide of copper and the arsenic acid was partly determined, partly calculated. After the liquid had been completely freed from the sulphurets, lime was still found, which gave 0·018 carbonate.

Hence these analyses furnished:—

Ca O	1·12				
Cu O	46·97	46·99	4	158·4	47·09
$As O^5$	34·42	32·42	1	115·0	34·19
HO	19·31	19·31	7	63·0	18·82
	100·70	99·84		336·4	100·00

The lime has not been considered in the calculation, which was, indeed, very embarrassing. The empyric formula would then be:—

$$4\ Cu\ O + As\ O^5 + 7\ HO;$$

which was changed into—

$$2\ (Cu\ O + HO) + (2\ Cu\ O + As\ O^5 + 5\ HO).$$

We can adduce no proof of the correctness of the analyses; it is merely the analogy with other arseniates that speaks for it. For what could prevent us from writing—

$$(Cu\ O + HO) + (3\ Cu\ O + As\ O^5 + 6\ HO)\ ?$$

But what does analogy prove in this case? Likewise nothing. For if the series of the naturally-occurring hydrated arseniates after

* *Vide* these Annals, vol. xxxiv., p. 218.

the best analyses and calculations made with them are reviewed, it remains still doubtful in which of Graham's modifications they ought to be classed, as the water may be disposed in an arbitrary manner. To elucidate this by some farther examples, we may, for instance—

Instead of 2 Cu O + As O^5 + 6, 5, 3 HO, write $\left\{\begin{matrix} HO \\ 2\,Cu\,O \end{matrix}\right\}$ + As O^5 + 5, 4, 2 HO.

Instead of (3 Cu O + As O^5 + 8 HO) write (2 Cu O + As O^5 + 7 HO) + (Cu O + HO).

Instead of (2 Cu O + As O^5 + 6 HO) + 3 (Cu O + HO) (Kupferschaum), write (3 Cu O + As O^5 + 7 HO) + 2 (Cu O + HO).

In the formula of seorodite two kinds of salts are introdueed; viz.—

(2 Fe O + As O^5 + 6 HO) + (Fe^2 O^3 + As O^5 3HO).

But which may be altered, if the first part is arranged in the same manner as it is in the pharmaeolith; viz.—

$\left\{\begin{matrix} HO \\ C2\,Fe\,O \end{matrix}\right\}$ + As O^5 + 5 HO, etc.

If we, however, turn to the anhydrous natural arseniates, we find that the arseniate of lead of Johann Georgstadt, analysed by Wöhler, and the Berzeliite, are the only ones whieh allow of no doubt. It was ascertained that they are both terarseniates. Whereas the hedyphane, according to the analysis of Kersten, and the Nussierite, according to that of Barruel, are by no means terarseniates, provided these analyses be correct. For the first of these minerals is calculated a formula which is remarkable for its symmetry; viz.—

3 Pb Cl + 4 [(1½ Pb O + 2 Ca O) ⅜ + (1½ PO^5 + 2 As O^5)].

The formula of the Nussierite is, with reference to the proportion between its oxacids and bases, conformable:—

Pb Cl + 6 [(1½ Pb O + ½ Ca O) ⅜ + $\left\{\begin{matrix} PO^5 \\ \frac{1}{5}\,As\,O^5 \end{matrix}\right\}$]

In this instanee, the oxide of iron mentioned by Barruel, as originating from the gangue, has been left out; and even if it had been taken as an essential constituent part of the mineral, even this would not have rendered possible the assertion of a terarseniate. The composition of the hedyphane could also have been expressed by the following formula:—

Pb Cl + 2 Pb O $\left\{\begin{matrix} 1\frac{1}{2}, (2\,PbO + \left\{\begin{matrix} As\,O^5 \\ \frac{2}{5}\,PO^5 \end{matrix}\right.) \\ 3, (2\,CaO + \left\{\begin{matrix} As\,O^5 \\ \frac{2}{5}\,PO^5 \end{matrix}\right.) \end{matrix}\right.$

Which, however, does not faithfully represent the amount of lime and arsenie acid (or of the latter alone): the first by 1 per cent. too low, the second by 1 per cent. too high. A similar alteration in the formula of the Nussieritc cannot be brought about. Pb Cl + 4 Pb O ought then to be admitted. Both the minerals, however, allow of a third formula, by which the phosphates and arseniates would be represented by 2½ of the bases. That such in general do occur is out of the question; but whether they do exist in our case is very doubtful.

From all these salts of lead, however, no consequence may be drawn with reference to arseniates, all of which contain phosphoric acid; and it seems probable that the arsenic follows the type of the phosphoric acid, nearly in the same manner as sulphate of copper that of sulphate of iron, and, *vice versa*, on their combination with water during crystallisation; and hence the only indisputably, by itself, constituted terarseniate, would be the Berzeliite. And consequently it follows, that this mineral is of the greatest interest for mineralogy, and of the highest importance for scientific chemistry.

May I be allowed to add a few words with reference to the Berzeliite. Berzelius, in his *Jahresbericht* xxi., rejected this name, proposed by myself, and recommended another. However successful and busily employed again in recent times the great and most esteemed man was in contriving new names, in this case, for reasons which find their explanation in human nature, he failed. The argument adduced against my proposal, that another mineral bears already the same name, is of no consideration, for the name berzeline was given to a child not yet born, to a mineral the properties of which are not ascertained. The advice of Berzelius to call it talk-pharmakolith is very ill chosen; for not only would talk-pharmakolith be identical with pikropharmakolith, but my mineral, as I think I have (in its proper place*) shown clearly enough, has nothing in common with the pharmakolith, except that they both contain lime, magnesia, and arsenic acid; but the circumstances are very discrepant, and their amount of water is likewise opposed to their being put upon a parallel. Finally, the mineral is by no means to be considered as a mixture; both the principal salts, the terarseniate of lime, as well as that of magnesia, are in the same way combined in definite proportions as their carbonate and silicates with the bases in the bitterkalk, augit, and hornblende. The adoption or nonadmission of the respective

* These Annals, vol. xxxiv., p. 216.

names may be left to the decision of impartial naturalists. For the sake of such a trifle as a name, I will waste no further words.

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ON THE DISTRIBUTION OF MINERAL SUBSTANCES IN INDIVIDUAL ORGANS OF PLANTS.*

BY DR. A. VOGEL, JUN.

The inorganic constituent parts are not in the same manner distributed throughout the whole plant, but they are in its several organs variously grouped. The ashes of the root and those of the trunk differ not only quantitatively, but also qualitatively from the ashes of the leaves, flowers and fruit. Hertwig, at the request of Prof. Liebig, showed that this is the case with reference to some plants.† For instance, the ashes of the tuber of potatoes are essentially different from the ashes of the herb of potatoes, the ashes of the bark are again different from those of the wood. I made some experiments with residues of ashes of individual organs of plants, with the view of assisting in finding out the laws by which the distribution of fixed substances in the individual organs of plants are regulated. Since in these experiments it was not the ashes themselves, but rather their mutual relation which was to be considered, it was naturally totally indifferent which was the plant that became matter of investigation. I therefore selected such plants as could easily and completely be converted into ashes; for the analysis of ashes containing much coal, viz., those which on continued ignition still contain 3—4 per cent. coal is always liable to great mistakes.

Through the kindness of Counsellor de Martius, I obtained from the Royal Botanical Garden at Münich several parcels of plants, which, their individual organs having been separated and washed, were reduced to ashes. To separate the soluble parts from those that are insoluble, I treated the ashes with boiling water. The residue insoluble in water was then dissolved in muriatic acid, and the phosphoric earths as well as the oxide of iron were afterwards, by caustic ammonia freed from carbonic acid, precipitated from their acid solution. The liquid was then filtered, and the lime determined by oxalate of ammonia, and after this had been separated the magnesia was precipitated by phosphate of soda.

I selected for the first experiment the ashes of pyrus spectabilis, and analysed the ashes of the trunk, the leaves and fruits each by themselves.

1. *Trunk.*—The trunk, after having been cut into small pieces, burns easily, and on being calcined over a spirit lamp finally yields white ashes amounting scarcely to 0·1 per cent. carbon. Since they contained carbonic earths in considerable quantities, it was necessary to moisten them after calcination with carbonate of ammonia, to restore the carbonic acid which was driven off by the heat. Water dissolves but little of the ashes; in the watery solution, which is of a feeble alkaline reaction, are no phosphoric alkalies, but merely traces of carbonates contained. The constituent parts soluble in water amount to 4 per cent. These ashes consist chiefly of carbonate of lime amounting to 82 per cent. Magnesia enters only at an admixture of a trifle per cent. The ashes contain 8 per cent. of insoluble phosphates, viz., phosphates of lime and phosphates of magnesia.

2. *Leaves.*—The ashes are perfectly white and little soluble in water, which liquid extracts from them 7 per cent. of alkaline carbonates with traces of sulphate of potassa, chloride of sodium and phosphate of potassa. These ashes, like those of the trunk, chiefly consist of carbonate of lime; in them, however, amounting to less by 10 per cent. The phosphate of lime and magnesia amount in these ashes to 10 per cent. The quantity of magnesia is nearly twofold, it was 4·9 per cent. and is now 9·76 per cent.

3. *Fruits.*—Totally discrepant from both the ashes of the trunk and leaves are those of the fruit. The soluble parts of the other ashes amounted to 4—7 per cent., those contained in these ashes were 33·1 per cent., hence one-third of the whole quantity, which consisted of equal parts of alkaline carbonates and phosphates. The quantity of carbonate of lime is diminished to 37 per cent., whereas the phosphate of lime and magnesia augment to 18 per cent. The phosphoric combinations, therefore, in the ashes of the fruit amount to more than one-third, namely, to 36—38 per cent. It is striking that some traces of silica are met with only in these ashes.

The amount of iron which has been determined by special experiments diminished from trunk to fruit. The quantity of iron, however, in the ashes of this plant is not material, amounting even in the trunk scarcely to 0·5 per cent. According to this analysis, the ashes are composed of:—

Trunk.

Alkaline carbonates	4·6
Carbonate of lime	82·2
Carbonate of magnesia	4·9
Phosphate of lime and magnesia	8·8
	100·5

* *Annalen der Chemie und Pharmacie*, July, 1844.

† *Vide* these Annals, vol. xlvi. p. 97.

Leaves.

Alkaline carbonates, with traces of chloride of sodium, sulphate of potassa and alkaline phosphates	6·8
Carbonate of lime	72·9
Carbonate of magnesia	9·76
Phosphate of lime and magnesia	10·5
	99·96

Alkaline carbonates	1·9
Alkaline phosphates	14·1
Carbonate of lime	37·
Carbonate of magnesia	5·52
Phosphate of lime and magnesia	18·6
Silica	3·7
	97·92

Fruit.

If we compare the composition of these three ashes, we arrive at the following conclusions :—

1. The amount of salts soluble in water augments nearly exactly eight times, from trunk to fruit. The soluble salts of the ashes of the trunk, leaves and fruit of the plant examined, are in proportion of 1 : 2 : 8. Here manifestly one intermediate proportion is left out. Is it, perhaps, formed by the flowers?

2. The phosphoric salts augment from trunk, and this is taking place at the expense of the carbonic combinations which from trunk to fruit are diminishing from 86 to 45 per cent.

To show the increasing amount of phosphoric acid in the ashes from trunk to fruit in one more instance, I examined three ashes of sambucus nigra solely with reference to their phosphoric acid. The phosphoric acid was determined after a method communicated to me by Prof. Liebig, a method which for its exactness and facility of execution is preferable to any other. The ashes to be investigated for phosphoric acid are merely to be dissolved in nitric acid and the solution precipitated by an excess of acetate of lead. The precipitate contains phosphate of lead and sulphate of lead, if sulphuric acid was present, and basic nitrate of lead. It is to be calcined and weighed. It now consists of sulphate of lead, phosphate of lead, and oxide of lead. It is then again to be dissolved in nitric acid, afterwards sulphuric acid added, and next some alcohol, and the obtained sulphate of lead is to be weighed. From this the quantity of lead is calculated, which, as well as the sulphuric acid, the amount of that latter acid having been determined on treating another portion of the ashes by baryta, are deducted from the weight of the sulphate and phosphate of lead and oxide of lead. The remainder is phosphoric acid.

The quantity of phosphoric acid found by this method in the ashes of the trunk amounted to 10·5 per cent. in those of the leaves to 13·6 per cent. in those of the fruit to 20·3 per cent.

It is naturally impossible by a few analyses of ashes of plants to ascertain a general law; for the proportion of fixed constituent parts of individual organs differs in various genera of plants. The cereals, for instance, contain in their fruit no constituent parts which are soluble in water, whereas their straw contains them in no inconsiderable quantities.

It is to be regretted that the analyses of ashes, if conscientiously executed, require much time, to which circumstance it may perhaps be ascribed, that till now no sufficient number of analyses has been performed. But the first impulse having been given by Prof. Liebig, in time this want will certainly be supplied.

—nt—

MEMOIR ON OSMIUM.

BY M. E. FREINY.

The investigations which I have undertaken with the view of demonstrating that almost all the metals, in combining with oxygen, may form organic acids, are divided into two parts.

In the first, which comprises several memoirs which I have had the honor of communicating to the Academy, I have examined the principal properties of the metallic acids formed by the metals belonging to the first four sections of M. Thénard.

I have reserved, for the second part of my work, the study of the acids which the metals in the last sections may produce.

The memoir which I now present belongs to this new series of investigations.

Among the acidifiable metals belonging to the last two sections, osmium is certainly one of the most remarkable, which is found in great abundance in platinum ore, and which, in combining with oxygen, produces a volatile and crystallisable acid.

It was impossible to examine the principal reactions of osmic acid without at the same time undertaking the study of osmium; for, as is known, its chemical history is still incomplete.

In order to prove it, I have but to quote here the opinion of Berzelius, who says, at the conclusion of his important memoir on the metals found in platinum ore, "that the experiments he has detailed can be re-

* *Comptes Rendus*, No. 10, Sept. 2, 1844.

garded only as a sketch of the long and difficult history of osmium."

If, since Berzelius, no chemist has followed up any examination of osmium, it is because few metals present such a combination of difficulties in their study.

Indeed, osmium is ordinarily combined, in platinum ore, with iridium, and this osmiuret is difficultly attacked by chemical reagents.

The combinations of osmium are so analogous to those of iridium, that their separation is often incomplete and their distinctive characters insufficient. It must be acknowledged, besides, that the vapors of osmic acid, which produce in a short time painful ophthalmia and corrosions of the skin, always render these investigations dangerous.

I thought that, to undertake a complete work on osmium, it was necessary, in the first place, to find a process by means of which easily to attack the osmiuret of iridium, and afterwards to obtain a crystallised compound which would not disengage the vapor of osmic acid in the air, and which might serve at need for preparing the principal combinations of osmium. I think that I have completely attained this twofold object.

I have already made known to the Academy the process which I use for extracting from the platinum ore all the osmium which it contains; I will here add only a few details which complete my former communication.

The residues of the platinum ore are presented under two different aspects: they are ordinarily in black powder, but they are also found crystallised in large bracteæ.

The residues in black powder are, in general, very poor in osmium, and contain about 20 or 25 per cent. of iridium.

When it is proposed to extract osmium, it is convenient to operate on the residue crystallised in large bracteæ. By calcining it with three parts of nitre, it is converted into osmiate and iridiate of potassa.

These two salts, treated by nitric acid, immediately give osmic acid.

In order to extract the osmium which remains in the state of oxide, the residue of the foregoing operation is treated by nitro-muriatic acid; it is precipitated by sal-ammoniac, and the double salt is submitted to the action of sulphurous acid.

I have said, in my first memoir, that iridium enters, in this case, into solution.

A red salt remains, which is an ammoniaco-chloride of osmium, which gives pure osmium when calcined in a current of hydrogen.

All the osmium contained in the platinum ore is thus obtained, on one hand, in the state of osmic acid, and, on the other, in the state of metallic osmium.

DETERMINATION OF THE EQUIVALENT OF OSMIUM.

The new combinations of osmium, which will be described in this memoir, having enabled me to prepare, by different processes, pure osmium, I have thought that it would be interesting to determine anew the equivalent of this metal.

It will be remembered that the equivalent of osmium was obtained, by Berzelius, by reducing the anhydrous potassio-chloride of osmium by means of phosphuretted hydrogen gas. The number 1244·49 is adopted for the equivalent of this metal.

Taking for a basis the very accurate experiments of Berzelius, which at once prove that osmium is completely converted into osmic acid when held in a dry current of oxygen, and that this acid is entirely absorbable by caustic potassa, it is evident that by burning a known quantity of osmium in oxygen, and by determining the quantity of osmic acid formed, I had the necessary elements for fixing the equivalent of osmium.

It is evident that this process is similar to that which Dumas and Stass employed for the determination of the equivalent of carbon.

These chemists burned pure carbon in oxygen, and weighed the carbonic acid which was formed.

In the same manner I burned osmium in oxygen, and I determined the weight of the osmic acid which was produced.

I would observe that it is also by the direct combustion of osmium in oxygen that Berzelius analysed osmic acid.

I operated the combustion of osmium in a tube divided into two parts by twisting the glass. I placed the osmium in the first part of the tube, and in the other, pieces of potassa. A tube containing potassa, placed in connexion with this apparatus, did not change in weight during the experiment, and proved that the osmic acid was entirely absorbed in the first tube.

I avoided, in the arrangement of this apparatus, the employment of corks, which immediately reduce the osmic acid.

It results from several analyses, whose details are given in my memoir, that, in osmic acid, 4 equivalents of oxygen are combined with a quantity of osmium represented by the number 1247·8, which does not differ essentially from that found by Berzelius.

Although my experiments agree with those of Berzelius, I do not consider the equivalent of osmium as definitively fixed. I will return to this question in an especial memoir.

Among the combinations of oxygen with osmium, that which contains 4 equivalents of oxygen is the only one which has hitherto been regarded as a metallic acid.

Osmic acid may, indeed, combine with the alkalis, and form salts in which the properties of this acid are disguised.

I have as yet been unable to prepare crystallised osmiates. These salts appear to be deliquescent, and are partly decomposed by water.

I will here make known a new combination of osmium and oxygen, to which I give the name of osmious acid, which, combining with bases, gives perfectly crystallised salts.

An evident vacuum existed in the series of the oxidation of osmium; Berzelius has admitted the existence of a chloride represented by the formula Os Cl^3, but the oxide corresponding to this chloride had not yet been produced.

The experiments which I am about to describe, prove that the compound Os O^3 is an acid which can combine with bases, and form crystallised salts.

PREPARATION OF THE OSMITES.

The osmites are prepared in a general manner by deoxidising the osmiates.

It is thus that, when a few drops of alcohol are poured into a solution of osmiate of potassa, the liquor is heated, aldehyd is disengaged, it turns of a rose color, and very soon deposits a crystalline deposit of osmite of potassa. As this salt is insoluble in the alcoholised water, the liquor is completely decolored, and no longer retains osmium in solution.

If an osmiate is put in contact with a body capable of slowly absorbing oxygen, the crystals of osmite which are deposited are then voluminous. It is thus that, when osmiate of potassa is mixed with a nitrite, beautiful crystals of osmite of potassa may be obtained in the form of octohedrons.

In this experiment, the nitrite absorbs a portion of the oxygen of the osmic acid, and is converted into nitrate.

The soluble osmites may also be prepared by treating an alkaline osmiate by deutoxide of osmium, which is immediately dissolved.

The preparation of these new salts does not, therefore, present any difficulty.

(*To be concluded in our next.*)

ON THE ATOMIC WEIGHT OF ZINC AND IRON.*

M. Pelouze communicated to the Academy of Sciences at its meeting of the 12th of August, the following extract of a letter from Berzelius to M. Laurent:—

"M. Erdmann (a Swedish chemist) has examined the atomic weight of zinc, which he finds different from that which M. Jacquelain and M. Favre admitted as the result of their experiments. Erdmann makes it 406·591. MM. L. Swanberg and Norlin have determined the atomic weight of iron; the mean of fourteen experiments is 349·523.

"The atomic weight of zinc would not be, therefore, a multiple of the equivalent of hydrogen, but of the atom = 6·25.

"The atomic weight of iron is evidently a multiple of 12·50."

* *Comptes Rendus*, No. 7, Aug, 12, 1844.

ACTION OF SOME OF THE ALKALINE SALTS UPON THE SULPHATE OF LEAD.*

BY J. LAWRENCE SMITH.

It has been for some time known, that certain neutral salts possess the property of dissolving to some extent the sulphate of lead, which property belongs neither to the acids or bases constituting these salts. By referring to Berzelius' *Chemistry*, it will be found that the acetate and nitrate of ammonia are among the number. "1 part of the sulphate was dissolved in 47 parts of a solution of the acetate, of sp. gr. 1·036; and in 172 parts of a solution of the nitrate, of sp. gr. 1·144." In the *Annalen der Chem. und Phar.*, vol. xxxiv, 235, will be found the following statement under the head of *Reactionem*:—"Sulphate of lead is easily dissolved, and in a large quantity, by a solution of neutral tartrate of ammonia. A concentrated solution forms after some time a stiff jelly, like silica." This last is no doubt a double tartrate of lead and ammonia.

I had also observed some time previously, that a solution of the citrate of ammonia, when poured upon the sulphate of lead and allowed to stand, altered the character of the sulphate, and this, with the other fact above stated, led to the examination of what was really the action of these as well as other ammoniacal salts in general, upon the sulphate in question, and it is found that in every case it was decomposed.

Citrate of Ammonia.—If a solution of citrate of ammonia be poured upon the sulphate of lead and shaken together, the clear solution will be found to contain the sulphate of lead, as shown by hydrosulphuric acid, and a salt of baryta—(taking care in testing

* From *The American Journal of Science and Arts*, July 1844.

with the baryta to acidulate first with pure nitric acid, to prevent the formation of the citrate of baryta). If they be allowed to remain several weeks in contact, the solution will be found to contain more lead, the sulphate having undergone decomposition, sulphate of ammonia and a double citrate being the result; as this latter salt is not very soluble, a large portion of it remains in the form of a precipitate. The rapidity of this change is in proportion to the concentration of the solution of the citrate. If instead of performing the experiment in the cold, we boil a tolerably concentrated solution of the citrate with the sulphate of lead, a very large quantity of the latter will be dissolved, and the solution become perfectly transparent; if it be set aside and allowed to cool, in the course of a few hours an abundant white precipitate will be formed, and upon testing the clear solution, sulphuric acid, ammonia, citric acid, and oxide of lead will be found present. The precipitate, when washed, affords citrate of lead and ammonia. I was at first inclined to think it simply a citrate of lead, attributing the ammonia present to some of the citrate not washed out; but from its possessing certain characters which do not belong to the simple citrate, I consider it a double of lead and ammonia. It contains not the slightest trace of sulphuric acid. It was not analysed, from the difficulty of obtaining it perfectly pure, as the water used to wash it decomposes it, and as yet this difficulty has not been surmounted. So then the result of the action of the citrate of ammonia upon the sulphate of lead is, first to dissolve it, and subsequently to decompose it, forming the sulphate of ammonia and citrate of lead and ammonia.

Tartrate of Ammonia.—If a solution of this salt be added to the sulphate of lead and shaken with it in the cold, the clear solution will be found to contain both lead and sulphuric acid; and if set aside for a few weeks, the precipitate will have changed its character, having assumed a crystalline nature; the solution will no longer contain lead, but the quantity of sulphuric acid present will be found to have increased. The precipitate now consists of tartrate instead of sulphate of lead, which is completely soluble in dilute nitric acid, affording no precipitate with a salt of baryta. If the mixture of the tartrate and sulphate be boiled, this change takes place more rapidly, and in a manner somewhat different from the case of the citrate; the sulphate will not be dissolved in such large quantities, and, moreover, by continuing to boil the solution after the sulphate has been completely dissolved, the tartrate forms during the ebullition, and is precipitated in little shining crystals. If the ebullition be continued a sufficient length of time, the whole of the lead previously dissolved will combine with the tartaric acid. This is different from what takes place with the citrate, which, when boiled upon the lead salt, dissolves it, and no length of ebullition will produce a precipitate. The action of the tartrate is first to dissolve the sulphate, decompose it in part, and form a double tartrate of lead and ammonia, which last salt is subsequently decomposed by continued contact with water, or still more rapidly by its solution being boiled.

Acetate of Ammonia.—This salt also dissolves to some extent the sulphate of lead, but not so readily as either of the above salts. If the solution be boiled and evaporated to dryness, crystals of sulphate of ammonia are obtained, and an uncrystallizable salt of lead, probably an acetate of lead and ammonia; from the difficulty of separating the sulphate of ammonia from it, it is impossible to pronounce positively whether it is a double salt, or simply an acetate of lead. We see in this reaction the existence of a soluble salt of lead and the sulphate of ammonia simultaneously in the same solution, without a precipitate being formed.

Oxalate of Ammonia.—Dissolves but slightly the sulphate of lead, owing, no doubt, to the impossibility of forming a double salt; but it will nevertheless decompose largely, the sulphate furnishing the oxalate of lead.

Muriate of Ammonia, if boiled with the sulphate of lead will decompose it instantaneously, furnishing the chloride of lead and sulphate of ammonia.

The *Nitrate of Ammonia* does the same, forming nitrate lead and sulphate of ammonia.

The *Carbonate* and *Succinate of Ammonia* produce similar effects.

The action of most of the corresponding solts of potash and soda was examined, and with very similar results. The fact is, it would appear that those alkaline salts which dissolve the sulphate of lead, decompose it, without reference to the time occupied in the solution, as in the case of carbonate of ammonia, which decomposes the sulphate at the very instant of its solution; and it is impossible to detect at any one time other than a trace of lead in solution, whereas the quantity of sulphuric acid is constantly increasing.

The explanation is clear: the sulphate of lead is a salt with a strong acid and feeble base; the alkaline salts used contain feebler acids and stronger bases; they dissolve the sulphate, thus affording an opportunity for

the acids and bases to act upon one another, under favorable circumstances, and to follow a natural law in chemistry, the stronger acid combined with the stronger bases, and *vice versa*.

From the above facts, some important hints might be afforded to analytical chemistry, for it will be at once seen that the presence of any of the alkaline salts in a solution from which it might be wished to precipitate lead in the form of sulphate, would affect the accuracy of the result. What is true of the sulphate of lead, may be found also true for other insoluble salts. Moreover, this shows the importance, in the analysis of mineral waters for instance, of weighing well the relative strength of the various acids and bases therein found, in order to ascertain what salts are present, and not to be contented with evaporating the water to dryness, and considering such salts as remain to be those existing in the water, for many of them may be formed during the evaporation. It is not at all improbable, that before many years the examination of mineral waters will be based as much upon calculation as upon analysis, the former of course being guided by the latter, and by certain laws not yet developed.

ON THE COMPOSITION OF CORALS AND THE PRODUCTION OF THE PHOSPHATES, ALUMINATES, SILICATES, AND OTHER MINERALS, BY THE METAMORPHIC ACTION OF HOT WATER.*

BY J. D. DANA.

At the last meeting of this Association I alluded to the discovery of *magnesia* in corals, by B. Silliman, jun., who had been engaged in chemical examinations of the corals of the Exploring Expedition. These investigations have been continued since, and lead to the conclusion that this is beyond doubt, the source of the magnesia in magnesian limestone. The analyses are not yet completed, and I cannot, therefore, give definite results.

Besides finding magnesia, Mr. Silliman has made the more remarkable discovery of a large per centage of phosphoric acid. Analogy had taught us that corals correspond in their nature and relations to the bones of higher animals, and we have now further evidence of this correspondence in their composition. The phosphates constituted, in some instances, 9 to 10 per cent. of the whole.

These facts seem to prove, what has long been suspected, that the primary limestones and dolomites are altered sedimentary limementary limestones, and that these limestones may be in part, of coral origin. The so frequent occurrence of phosphate of lime (apatite) in this rock, is explained by the same discoveries, and corroborates this view of its origin. The little fluorine which apatite contains (6 or 8 per cent.), adds additional probability to these conclusions; for although fluorine has not yet been detected in these polyp remains, by analysis, fluor spar is a common mineral in fossiliferous limestones, and often occurs in the cavities of shell and other fossils, as if proceeding from animal decomposition.

The same heat, then, that crystallised the limestone, crystallised also the apatite, splendid localities of which occur in the limestone of northern New York as well as in Orange County. It is universally admitted that this crystallisation took place under the pressure of an ocean, and we may believe that the heat was distributed by means of its waters, both permeating and superincumbent.

These heated waters, like the hot waters of igneous regions generally—fine examples of which are seen in New Zealand, as well as the Geysers of Iceland—contained silica in solution. Through the action of this silica on the lime and magnesia, and on the oceanic salts present, may have been formed the minerals *serpentine*, *scapolite*, *pyroxene*, *tremolite*, &c., so common in granular limestone and dolomite. Another source of silica is found in the clay which sedimentary limestones often contain, hydraulic varieties of which sometimes include 40 per cent. A hydraulic limestone from the Helderberg, N.Y., analysed by Prof. Beck, contained 36 per cent., 28 per cent of which were silica; and another from Rondout, Ulster County, N.Y., contained 24·50 per cent. of clay, 15·37 of which were silica, and 9·13 alumina. This may account for the occurrence of the above minerals without the infiltration of silica; yet the large amount of silica or siliceous minerals in some granular limestones, seems to require more than can be reasonably supposed to be supplied from this source. Moreover, the occurrence of silica in solution in regions of volcanic agency, is known to be frequent, and cannot in all instances be excluded in accounting for these metamorphic changes and crystallisations.

The alumina of the same clay in impure limestones uniting with the magnesia and silica, may have given rise to the *aluminous varieties of hornblende*, and the iron often

* Read before the Association of American Geologists and Naturalists at Washington, May, 1844.

present may have contributed towards producing the *dark ferruginous* varieties. The formation of mica may be explained on the same principles.

The presence of fluorine has already been alluded to: and this, with the silica and magnesia, appears to have produced the *chondrodite*, another very abundant mineral in our dolomites.

The alumina and silica with potash or soda from heated volcanic waters might have originated crystals of feldspar, albite, &c.

Where spinals have been formed, the alumina of the altered magnesian limestone may have predominated over the silica and thus have given rise to this mineral—an *aluminate of magnesia*. Spinal is usually associated in Orange County, N.Y., with *chondrodite*. and it seems probable that the little fluorine present at once took possession of the silica, and formed fluosilicic acid—for the attraction between fluorine and silica is known to be one of the strongest in chemistry—and thus combined, produced by uniting with magnesia the mineral *chondrodite*, which is a compound of silica, fluorine, and magnesia. Where spinals are not found, as with rare exceptions is the case in St. Lawrence County, N.Y., it may be owing to the large amount of silica present, or the absence of fluorine. Chondodrite is nearly as rare a mineral in northern New York as spinal.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

EXPERIMENTS ON THE NOURISHMENT OF COWS WITH BEET-ROOTS AND POTATOES.

BY M. BOUSSINGAULT.

Dr. Playfair has lately published some observations, which are of a nature to make it supposed that the butyraceous matter of milk may be derived from sugar and starch, as well as from the substances analagous to fatty bodies, which generally form part of aliments. At *first* sight, these observations seem conclusive. Unfortunately, Dr. Playfair, doubtless in haste to arrive at a conclusion, performed his investigations with such rapidity, that in *four days* he successively tried the influence of *four distinct regimens* on lactation; and in his hurry, the author was contented with analysing the milk, neglecting the determination of the principles soluble in ether which existed in the aliments consumed. It is thus that Dr, Playfair admits in hay 1½ per cent. of fatty matters, while it is now averred, that this aliment generally contains more than 3 per cent. Also, by assigning to the aliments employed the proportion of fatty matters most commonly met with in them, it is found that, of the four experiments, two justify the opinion which attributes the origin of the fat of animals to the bodies of a fatty nature which pre-exist in the alimentary vegetables; the other two, on the contrary, gave results which do not agree with this view.

In these two experiments, which, together, lasted *forty-eight hours*, and during which the cow received for nourishment, in one case, hay, potatoes, and beans, and in the other, hay and potatoes only, the butter contained in the milk collected in one day exceeded, by nearly 300 grammes, the fatty matter supposed to exist in the aliments.

If these two experiments are accurate, and I do not raise the shadow of a doubt as to their accuracy, it appears, indeed, that we must conclude, that the greatest part of the butter was formed from the fecula of the roots which constituted more than 12 kilogrammes of the daily ration.

I do not think, however, that an observation of *forty-eight* hours is sufficient for drawing, I do not say a similar conclusion, but any conclusion whatever as regards a question of alimentation. By restraining within too narrow limits the duration of an observation, the most erroneous consequences may be arrived at. For example, Dr. Playfair caused a cow to consume 6·3 kilogrammes of hay and 13·6 kilogrammes of potatoes, a ration containing at most 250 grammes of butter, and obtained 11·5 kilogrammes of milk, containing, according to analysis, 540 grammes of butter; there was, consequently, in the milk 290 grammes of fat more than was contained in the aliment. But the interval of 24 hours is so short, that I am persuaded that if nothing at all had been given the cow, which I suppose to be fat and in good condition, it would still have rendered, notwithstanding, from 8 to 10 kilogrammes of milk, certainly containing from 300 to 400 grammes of butter. Can it be concluded that the butter is derived from nothing? No, doubtless; and it would be admitted, as in experiments on inanition,

* *Comptes Rendus*, Aug. 19.

that in this case an animal forms the products which it yields by respiration and secretion, at the expense of its own substance, thereby losing in its weight.

At a period when I did not attach much importance to the presence of fatty principles in aliments, I had an opportunity of observing the unfavorable effect produced on milch cows by a ration comprising too large a proportion of potatoes. A cow fed with 38 kilogrammes of potatoes, and which also ate chopped straw, continued to give the milk it yielded under the regimen of hay; the milk gradually diminished, as is sometimes the case. Under the influence of this nourishment, which did not contain sufficient fatty matters, the cow suffered considerably; but it was necessary to continue it for a certain time, in order to perceive how thin it became. If the observation, which continued for 11 days, had lasted only 24 hours, the unfavorable result which was noticed would not doubtless have been observed.

If it was demonstrated that, in the nourishment of cows, sugar and starch directly aid in the production of butter, and that, consequently, roots and tubercles may without inconvenience be substituted for hay, grain, and oil-cakes, practice would very frequently draw considerable profits from this substitution. The question of the influence of such a regimen on lactation cannot, therefore, be too well examined, and it was on account of its importance and utility that I decided on feeding two cows with beet-roots and potatoes alone.

The two animals experimented on were in very similar conditions. Galatea, aged 7 years (No. 5 in the stable), had a calf ninety-six days old before the commencement of the observations. Waldeburg (No. 8) had calved forty days before; her calf was just taken from her. These two cows were on the regimen of the stable, which was composed, per head and per twenty-four hours, of

Hay	12 kilogr.
Potatoes	8·5 ,,
Beet-roots	12 ,,
Cake of Colza ..	7 ,,
Chopped straw ..	at discretion.

With this regimen, the average quantity of milk yielded by each of these cows was from 8 to 9 litres.

As it was important that the cows should take no nourishment besides that used in the experiment, they were deprived of litter, and, in order that they might not suffer from this deprivation, a floor of planks was established in their stalls, on which they reposed commodiously.

I was able to judge, from the whole of the weights taken in these investigation, of the state of thinness at which the two milch cows arrived in consequence of the alimentation with beet-roots and potatoes; and notwithstanding the compensating regimen of after-grass which they received in the interval of the two extreme experiments.

	Weight of the two cows.
During the normal alimentation, 8 days before the first experiment	1,205 kil.
After having been fed for some days with beet-roots	1,161 ,,
After seventeen days' regimen of the beet-roots	1,074 ,,
After having been fed with aftergrass	1,114 ,,
After fifteen days' nourishment with aftergrass	1,156 ,,
After having been fed with potatoes	1,073 ,,
After fourteen days' alimentation with potatoes..	1,040 ,,
Extreme difference ..	165 kil.

It was found, in fine, that the two cows experimented on lost, per head, 82·5 kilogrammes under the influence of the regimen of beet-roots and potatoes. This enormous loss sufficiently explained the state of thinness into which these animals fell, to repair which a very long time was required. No. 5 would not receive the bull; this cow had reacquired its good condition, but its milk constantly diminished, even to almost entirely disappearing. Waldeburg, No. 8, continued to give milk, still taking fat from her.

Thus, reckoning from the end of the experiment made with potatoes the cows put on hay for fifteen days, and on clover for a month, weighed:—

No. 5, 575 kilogr., having yielded 4 litres of milk per day.
No. 8, 578 ,, .. ditto .. 5 ,,

After 2 months' regimen of clover:—

No. 5, 610 kilogr., milk per day, 2 litres,
No. 8, 590 ,, ditto .. 6 ,,

the two cows had regained their original weight.

It evidently results from the facts which have just been adduced, that beet-roots or potatoes given alone are insufficient for properly nourishing milch cows, even when these aliments are administered in abundance or even at discretion, since the cows very often left a portion of the ration presented to them.

An alimentary ration may be insufficient from different causes: 1st, if the nourishment does not contain a quantity of nitro-

genous principles capable of repairing the losses of principles, likewise nitrogenous, which are eliminated from the organism; 2nd, if the digestible matters do not contain the carbon necessary for replacing that which is burnt in the respiration or passed off with the secretions; 3rd, if the aliments are not sufficiently charged with salts, particularly with phosphates, in order to restore to the economy the saline principles which are continually expelled from it; 4th, finally, and according to the views which have lately been published, the ration will be insufficient, if it be not sufficiently rich in fatty matters, to supply those which are carried away by the milk or by the other secretions.

These principles admitted, it is as well to examine whether the alimentary regimens to which the cows were submitted in the course of these investigations, would fulfil the various conditions which, taken altogether, constitute a complete aliment.

	Weight of the aliments or of products per 24 hours.	Principles contained.			
		Carbon.	Meat.	Phosphoric acid.*	Fatty matters.
Nourishment with beet-roots.	Kilogr.	gr.	gr.	gr.	gr.
A cow yielded: milk	6·15	449	230	7	246
Dry excrements†	1·22	488	..	..	43
		937	230	7	289
Beet-roots consumed	64·0	3358	830	29	64
Differences		+2421	+600	+22	—225
Nourishment with potatoes.					
A cow yielded: milk	4·55	355	192	6	197
Dry excrements	3·03	1212	..	..	18
		1567	192	6	215
Potatoes consumed	38·46	4079	869	42	77
Differences		+2512	+677	+36	—138
Nourishment with aftergrass.					
A cow yielded: milk	5·31	390	191	6	273
Dry excrements	5·13	2052	..	..	169
		2442	191	6	442
Aftergrass consumed	15·07	6122	1177	53	550
Differences		+368	+986	+47	+108

It is evident that the elements which are generally considered essential to nutrition were abundantly represented in the regimens which have been studied.

It is known that a cow burns, in 24 hours, by respiration, from 2 to 3 kilogrammes of carbon, at the same time that it passes from 300 to 400 grammes by the urine. The excess of carbon, which is constantly remarked in the aliments, is evidently sufficient for repairing the losses which take place in the modes which I have pointed out. It is also evident that, in the three regimens, the nitrogenous substances and the phosphates have always been in great excess in proportion to the same principles which existed in the milk estimated; this excess necessarily passes off in the dejections. Thus, in the nourishment received by the cows, there were sufficient sugar and starch, sufficient nitrogenous principles, sufficient saline substances for the production of animal heat, to repair all the losses occasioned by the secretions; and, however, of the three rations tried, two, that of the beet-roots and pota-

* Phosphoric acid forming phosphates of lime, magnesia, iron and potassa.

† According to my former analyses, I admit 0·40 of carbon.

toes, were really insufficient. These are precisely the two rations which contained a quantity of fatty principles, far inferior to that which formed part of the milk and dejections.

The facts which are collected in this memoir will, doubtless, receive many explanations. However, I think that their most natural interpretation, that, at least, which best agrees with the whole of the practical results which I have had an opportunity of collecting, consists in admitting that the aliments of the herbivora should always contain a determinate proportion of substances analogous to fat, destined to aid in the production of the fat of the tissues, or in the formation of several secretions which, like milk and bile, contain fatty matters in considerable proportion. If, notwithstanding an insufficient proportion of fatty principles in the food which they consume, cows continue to give the products which are obtained under the influence of a complete alimentary regimen, it is because they contribute to the elaboration of these secretions at the expense of their own fat. Every day, perhaps, during a limited time, a cow, placed in these circumstances, will yield the same number of litres of milk. There would be no sudden diminution; but each day, also, as I have proved, the cow will lose from 1 to 2 kilogrammes of its weight, and, if we persist in giving it an incomplete nourishment, however abundant it may be, the emaciation resulting from it may become so great as so to endanger the existence of the animal.

M. Dumas, after having read M. Boussingault's memoir, added that he had just received a letter from his honorable friend, in which he gives the details of an experiment which he has just concluded, on the fattening of pigs by means of potatoes.

Two twin pigs form the subjects of experiment. One weighed 60 kil. ·5, and contained 15 kil. ·48 of anhydrous fat. The other weighed 59 kil. ·5. It was subjected to the regimen of potatoes during 205 days. During this time it devoured 1,500 kil. of potatoes, containing 3 kil. of anhydrous fat. Now, by analysis, this animal gave 17 kil. 39 of fat likewise anhydrous. It is evident that this result is entirely contrary to the opinions which admit the formation of fat by the herbivora, and that it agrees with those which have been given in concert by MM. Boussingault, Payen, and myself.

IMPROVEMENTS IN REMOVING IMPURITIES FROM COAL GAS, FOR THE PURPOSES OF LIGHT.*

BY HENRY PHILLIPS.

This invention consists in purifying coal gas, by passing it through ammoniacal liquor, the ammonia in which has been rendered caustic by lime.

The ammoniacal liquor, produced in the gas works, is put into the vessels used in the lime-washing process, and as much recently-slaked lime is added thereto as will bring it to the consistence of cream of lime; the gas is caused to pass through this mixture, which is kept in agitation by the means ordinarily adopted in the lime-washing process. When the mixture becomes no longer effective for purifying the gas (which is ascertained by the ordinary tests), it is withdrawn, and the vessels recharged with ammoniacal liquor and lime.

The patentee claims the application of ammoniacal liquor, in which the ammonia is rendered caustic by lime, for separating impurities from the gas obtained by the distillation of coal.

AMMONIA IN THE MANUFACTURE OF STARCH, AND FARINACEOUS MATTERS.

Gentlemen—

I take the liberty to request your publication of the following discovery, which I have made, about three years since, and which I conceive will be found very useful to the public:—

In some experiments which I made on the process of making starch, and preparing farinaceous matters for purposes of food, I found that, for all the purposes of practical operation, liquid ammonia is the best agent for the purpose of dissolving gluten coloring and astringent matters, leaving only the fibre and the starch unchanged, and which, after washing two or three times, may be easily separated by the usual process of straining through a fine sieve, and drying as usually practised. The best degree of strength for use is sp. gr. 0·965, and it is superior to caustic soda or potash, as strong solutions of them act powerfully on the starch, while the ammonia produces no change in it, however long it may be kept in operation. It may be applied also in the gaseous

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* *Newton's Journal.*

way, by passing the ammoniacal gas through refrigeratory apparatus into vessels containing any kind of farinaceous matters, such as wheat, rice, peas, bruised potatoes, or such like matters; and in this case the ammonia from gas-liquors may be used by adding lime and distilling the vapors from them, as it is not necessary to use a perfectly pure ammonia for all the purposes of making starch; but the ammonia may be obtained from any known source. The ammonia, when saturated with gluten, may be obtained again by distillation, and used over again, and the gluten may then be applied to purposes of food, or any other purpose to which it may be found applicable; as an improvement in food it will be found highly useful, as the inferior kinds of rice, peas, and such like matter, after being steeped in ammonia for a few hours, and then well washed, will be found equal to those of the best quality. Close vessels are the best for conducting the operation, and in some cases a low degree of heat may be used without any injury, but it is not absolutely necessary, as the cold operation is sufficient for all practical purposes.

It is also an improvement to add a little ammonia to starch as a finishing process, however the starch may have been obtained, whether by the usual process of fermentation or by the use of dilute solutions of soda or potash, as it prevents the possibility of fermentation while in a damp state, and dries more rapidly.

I am, Sir, most respectfully,
Your obedient servant,
JOSEPH NASH.

P. S. Ammonia will be found preferable to potash or soda in removing glutinous matter from vegetable fibre, for the purposes of woven fabrics, or other manufactures.

28, Duke-street, Stamford-street, Blackfriars'-road, Sept. 17, 1844.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THE PHARMACEUTICAL PHANTOM.

Do the simple-minded, generous, and credulous men, who pay two guineas annually to the Pharmaceutical Society, ever ask themselves what benefit they, their posterity, or the public will receive by so doing? Do they contribute the money as a charitable donation, or do they earnestly expect some equivalent in return? If the former be the case, we never heard of charity being more grossly misapplied. Scarcely a tithe part of the amount is ever likely to reach the hands of the unfortunate and the distressed. But perhaps these benevolent individuals think it an act of alms-giving to enable, at their cost, Messrs. Savory, Bell, and Redwood to advance their worldly interest by continually advertising themselves to the public in their respective capacities of president, editor, and professor. Verily, fine feathers make fine birds; fine names make great men.

Surely, if charity be their object, it is a most unbecoming piece of ostentation for these members everywhere to exhibit publicly the receipt for their subscription in the shape of a very fine engraving misnamed a diploma. In truth, we shall recommend the Mendicity Society to get a very handsome receipt engraved and framed, as a bait to draw subscribers, as the experiment has answered so well in the case of the Pharmaceutical Society. However, the day is not far distant when the value of this diploma will be duly appreciated. When the members find this bauble, this badge of servitude, this child's rattle (a thing used for keeping its possessors quiet), brings no reputation to their name or gold to their coffers, then will the council have cause to rue having thus imposed on their gullibility. Woe betide them for having dared to give the shadow instead of the substance.

But probably these worthy men believe they are deriving, or will ultimately reap some return for their outlay. Perhaps they vainly imagine they are receiving some benefit from the library which is now circulating, limited and far too distant from their homes for the majority of the members ever to become acquainted with the title pages of the books. Perhaps they think the expensive chemical apparatus is exercising some magic influence in behalf of their scientific culture, or have they only purchased it for the half-holiday recreation of the officers of the society. Perhaps they fondly hope the lectures are conferring a sacred charm over their understandings, and that the lectures of the society have some vast superiority to those delivered at the Royal Institution, London University, and the thousand and

one medical schools of the Metropolis. Or perhaps they put their faith in some vivifying and regenerating power of their journal, the Newtonian judgment, the critical acumen and enlightening eloquence of its editor, the penetration, the philosophical depth and originality of its papers, its power of resisting pressure from without—and preserving unanimity within—the society, or to some indescribable advantage which the warm imagination of the members feel it to possess.

Oh, miserable and deluded men, cast out these fairy dreams which you so lovingly embrace from your heated brains, and learn ye that for two guineas annually ye can procure for use at your own homes handsome engravings, valuable books, chemical apparatus, and journals more than enough to supply your minds with a year's instruction and amusement.

We ask those members who believe what we have written to be true, why they lend themselves to support this *incubus*, this Pharmaceutical phantom got up for the purpose of levying contributions under the pretence, amongst some others, of fighting against a ghost (which the council shows, even nods occasionally to the members) with its teeth, its talons, and its terrors, under the name of Medical Reform.

W. B.

HISTORY, ANALYSIS, AND PRESERVATION OF ERGOT OF RYE.*

BY VICTOR LEGRIP.

(*Concluded from page* 367.)

The product *e*, ammoniacal hydrolate, gave on cooling a slight deposit of inulin, filtration was slowly performed; the liquor of a reddish brown violet, had the appearance of a *savonule;* the saturation of the ammonia by nitric acid, liberated a fatty acid, collected on a filter, with a portion of the coloring matter. Alcohol was added to the filtered liquor—there was a more abundant precipitate of coloring matter, and of a certain quantity of fungate of potassa.

The product of *f*, acidulated hydrolate of the residue, of a fallow yellow, was tested with ammonia. There was also a violet-brown precipitate; the remainder was also treated by alcohol. A slightly yellowish-white precipitate was immediately produced. Without filtering, the whole of the alcohol was removed by distillation; the remaining liquid was submitted to evaporation. The precipitate being redissolved, we in vain tried crystallisation: it was fungate of potassa. Evaporated almost to an extract, no deposit was formed in it. At this moment a drop of this quasi-extract, tested by ammonia, produced, without precipitate, a liquor of a very rich yellow color, which very soon dried on the capsule.

Wishing to account for the difference which we observed in the results obtained from the products of *e* and *f*, we redissolved the residue of the product *e*, which had been dried. We treated it with acidulated water, as with the product *f*, with the difference that we found nitric acid, and not sulphuric. The investigation followed like the foregoing—the results were the same: fungate of potassa and yellow coloring matter, acquiring much lustre on contact with the alkalis, especially with ammonia.

In the aqueous solution of incinerated charcoal, product *g*, there was a precipitate with nitrate of silver, by the salts of baryta, by oxalate of ammonia and by ammonia. The precipitate of silver, insoluble in an excess of acid, was a chloride, whose chlorine constituted a hydro-chlorate with another alkali than potassa; for, on a small portion, chloride of platinum produced no precipitate. We acquired the certainty that it was chloride of sodium. The precipitate produced by ammonia, collected and treated while moist by a concentrated solution of sulphate of potassa, gave small crystals of alum, &c.; it was therefore alumina. Lime was found in it in small proportion; scarcely rendered turbid by the salt of baryta.

The product *h*, solution by hydrochloric acid of the incinerated charcoal, gave by oxalate of ammonia a precipitate of oxalate of lime. In the same liquor, separated from the precipitate of lime, a precipitate of magnesia was obtained by means of potassa. In another test, the lime gave a precipitate of phosphate of lime (studied) by nitrate of baryta, a precipitate partly insoluble in an excess of acid.

In the product *i*, nitro-muriatic solution of the incinerated charcoal, sulphuretted hydrogen, caused a yellowish turbidness, hydrosulphate of ammonia, a black precipitate, with the ferrocyanuret is obtained, in the acid liquor an abundant blue precipitate. A well cleaned bar of iron, in a portion of the same liquor, was covered by a sensible layer by the nitrate of baryta, a white precipitate, soluble in an excess of acid. Finally, ammonia, potassa, and lime, produced an abundant white precipitate. One of these precipitates, decomposed by potassium, contained phosphoric acid.

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* *Journal de Chimie Medicale*, July, 1844.

Having ascertained that a decoction of ergot of rye reddened litmus paper, we thought that from the saccharine and amylaceous principles existing in it, there might be a reaction, giving rise to acetic acid. To ascertain it, we submitted to distillation a decoction of powdered ergot, and the product was received on the same test paper; the blue color underwent no change. We also, but still in vain, sought for this free acid as phosphoric acid. Finally, awaiting more complete certainty, we think, at present, that we ought to regard it as a small quantity of free fungic acid.

It has been thought that an ammoniacal salt should exist in ergot of rye; we have not been able to detect the presence of ammonia in any of the recent aqueous solutions; but we have ascertained that they continue to remain acid, or become nearly neutral. However, in both cases, it has always been possible to detect ammonia. This may be explained, we think, considering that in the spontaneous decomposition of the constituent principles of this hydrolate, ammonia may be produced by the vegeto-animal matter, and by the fungin of the fungic acid. It is thus that in a hydrolate of ergot of rye, or in the humid powder after the commencement of fermentation, we find the existence of an ammoniacal salt to be possible, and that we regard the free acid, in a recent hydrolate, as fungic acid.

It results from the analysis of ergot of rye, that 100 grammes of this substance, dried at 0 × 50, contained—

	Grms.
Thick fat oil, very fluid at 0 × 25 on a fine day	34·50
Amidine	2·75
Albumen	1·00
Inulin	2·25
Gum	2·50
Uncrystallisable sugar	1·25
Very brown resin	2·75
Fungin	3·50
Vegeto-animal matter	13·50
Osmazome	0·75
Fat acid	0·50
Ligneous fibre	24·50

Coloring principles { Red-brown, violet by an alkali, and fallow-red by an acid ... } Insoluble in alcohol
Of a fine yellow in ammonia ... } Soluble in alcohol ... } 0·50
Colorless in the last ... }

ODOROUS PRINCIPLES NOT ISOLATED.

Fungate of potassa	2·25
Chloride of sodium	1·50
Sulphate { of lime / of magnesia }	0·50
Phosphate of lime (sub)	1·25
Protoxide of iron	0·25
Copper	Sensible traces.
Silica	0·15
Water	2·50
Loss	1·35
	100·00

Being curious to be able to establish the mode of acting and the degree of action of some proximate product of ergot of rye, we made several experiments, which seemed most proper for our purpose.

According to M. Bonjean, of Chambery, the oil of ergot of rye is very poisonous. To convince ourselves of this we administered 6 grammes to a rabbit 45 days old. The animal remained without eating, under our eyes, and covered with a bell of metallic wire for 4 hours; during this time it did not give the slightest sign of uneasiness or impatience.

We may remark that, obtained by ether, it is very difficult to free this oil, at the ordinary temperature, from a last portion, and the odor of this solvent. This leads us to believe that the bitter taste noticed by M. Bonjean in this oil was due to the complete estimation of this menstruum. The same author, to establish the poisonous quality of this product says, that 12 drops of this oil equal in action 32 grammes of powdered ergot: either ergot of rye is inoffensive in this dose, or the comparison cannot be set up; for 6 grammes of this oil, swallowed by our feeble subject, represent more than 120 drops. Moreover, in the course of our experiments, we have too often tasted it, and that in too large a quantity not to be able to say with M. Vanquelin. Thinking that it would be more easy to prove the poisonous action of ergot by always submitting to its effects, the same little animal instead of giving it anything to eat after the experiment with the oil, we made it swallow 24 grains of alcoholic extract, rendered semi-fluid by a little water. The disgust caused by the swallowing of this substance will be understood. Indeed, the odor and taste of this experiment are repulsive. What happened? The animal was not more seriously affected by this extract than it had been by the oil; and four hours after the experiment, restored to liberty, hastened to make up for lost time on the aliments which were given to it. This extract having appeared to u to merit our attention almost exclusively, we have confined to it our investigations; we

leave to studious practitioners the task of elucidating better this still too obscure point of toxicology.

In 1832 M. Vallet communicated to the *Société de Pharmacie* a succinct analysis of ergot of rye, in which is mentioned a matter, crystallising in bracteæ (ergotine): we have not been able to meet with it in our investigations; we regret that the author, M. Vallet, has not given his mode of obtaining it, nor described its properties.

A WORD ON THE PRESERVATION OF ERGOT OF RYE.

Acknowledging the medicinal properties of this substance, can it be admitted that it is unalterable? Can we partake of the opinion which admits that old ergot of rye even bitten by insects, has lost none of its properties? We cannot adopt this opinion, and we think, on the contrary, that this substance demands so much the more care as it is easily alterable. Exposed to the air, to moisture, and light it promptly changes in state, and it is impossible for its degree of action not to be modified. We have preserved it absolutely intact for several years, and we think that its preservation may be prolonged almost indefinitely by the following precautions:—1st. To prepare the powder with recent and well-dried ergot. 2nd. To expose the powder to a multiplied temperature by 45 or 50 in order to dry it promptly and perfectly. 3rd. To heap it up and enclose it hermetically in glass vessels containing a hectogramme, at most. 4th. Finally, to remove it from the action of light, either by confining it in a dark place, or covering the vessels.

ON THE DOSING OF IODIDE OF POTASSIUM.*

BY A. DUVILLE.

LETTER TO M. CHEVALLIER.

Six months ago I was witness of a fact which proves the high dose in which iodide of potassium may be employed.

If this note appears to you at all interesting to the practice of pharmacy, I beg you to communicate it to the Society (of Pharmacy) of which I have the honor to be one of the corresponding members, and to cause it to be inserted in the *Journal* which it publishes with so much impartiality.

Towards the end of 1843 I was charged with preparing, for a patient attacked with a venereal bubo in the left groin, an ointment thus composed:—

Iodide of potassium	16
Lard	30

This ointment was made according to the codex, bruised on porphyry. It was to be employed in frictions, three times a day, and at the same time the patient had to swallow, also three times a day, lumps of the size of a nut of an antiblenorrhagic opiate composed of balsam of copaiba, cubebs and caustic magnesia (to solidify the copaiba).

By a mistake which might have been fatal to him, but which will easily be understood, when it is known that the patient was compelled, for certain reasons, to follow up the above treatment secretly, the first friction having to be made at night, he did it in the dark, and used for this purpose the astringent opiate; immediately after he swallowed (I know not how he could have done it) a lump of the ointment prescribed of the size of a muscovado nut. He continued the same mode of treatment, and always in the same error, until the two pots were finished. In this case he did as many patients do, who, in such cases, often exceed the limits of the prescription, in the hope of being more speedily cured, and took the whole in forty-eight hours, (46 grammes of ointment and 64 of astringent opiate employed in frictions.)

Great was my surprise when, after the error noticed, he told me that the bubo had changed its place, and that it was now situated in the middle of the thigh.

I leave physicians to decide whether this is possible, and whether the patient was really affected with a syphilitic bubo or with a gland of quite another nature.

The fact is, that a new quantity of the ointment, made in the same proportions, but employed this time as it should have been in the first instance, caused this singular tumor to disappear in a few days. When I saw it in the middle of the thigh, it rolled under pressure of the fingers. He assured me that he had not perceived any pain in the epigastrium, nor in other parts of the digestive tube, only he must have had a great desire to be cured, to *masticate*, in some measure, this fat, for which he has since retained a horrible disgust. The opiate, on its part, had caused him to suffer much, by producing the effect of a vesicatory incessantly irritated by rubbing with a cloth, in the angle of the abdomen and the commencement of the thigh.

To sum up: Can 16 grammes of pure iodide of potassium be absorbed by an adult in forty-eight hours, without any accident resulting? This is not my opinion. Then, in this case, however exceptional, was not the fatty body employed in the preparation of the ointment opposed to the entire absorption of the iodide? Did it not form with the gastric

* *Journal de Chimie Médicale*, July, 1844.

juice an emulsion which would pass intact into the chyliferous vessels? Finally, was the deleterious action of medicine averted by a particular cause?

It is for physicians to solve the question already so often put, whether iodide of potassium may be employed in very large doses without danger.*

In therapeutics, this medicine is very valuable, and it would be desirable to fix the quantity in which it may be employed.

THE MEDICINE CHEST.

We extract the following from an interesting paper "On the Use and Abuse of Domestic Remedies," by Sir George Lefevre, M.D., published in the *Lancet*, for August 24, 1844:—

"CALOMEL.

"If a child complain of headache and sickness, and its skin is feverish, the mother is persuaded that it is a billious attack, and administers a dose of calomel, which produces vomiting of a yellowish fluid, proof sufficient that the treatment was proper and rational. The patient gets better rapidly, and the mother is fully persuaded that she has done as well as the doctor could have done under these circumstances, congratulates herself upon having saved her child a serious illness, and herself a physician's fee, or the price of six draughts from the apothecary's shop, and in all these particulars she is quite right. Many a serious illness has been cut short by a dose of calomel timely administered. It would be well if she confined herself to so much knowledge, and to the administration of single doses, *pro re natâ;* but success makes bold and practice makes perfect, and such wise saws lay the foundation to serious consequences. It does not follow that if a robust child who has over-eaten itself may be relieved by such means, that a more delicate one, whose sin consists in having a white and loaded tongue, should be submitted to the same discipline, and this is, nevertheless, one of the commonest mistakes in domestic treatment. I had an opportunity of proving this at a very early period of my practice, when travelling with a family abroad. The mother of several children, and fully experienced in these matters, resorted to her medicine chest, and weighed out the calomel to cure the white loaded tongue of a deligate girl of ten years of age, whose appetite became daily impaired, and her digestive functions more deranged in spite of such treatment. Being at length consulted, I recommended a totally different plan of treatment, and prescribed a tonic. I did not add to the confidence I might have previously inspired by such a suggestion. A white tongue could only indicate a foul state of stomach and a certain degree of fever, which called rather for purgatives than strengthening remedies, which, by increasing the feverish state, must fail in their intentions. It was not till more mischief was threatened, that the tongue became more white, and the muscular powers more feeble, that the old plan was laid aside. Not wishing to prove any superior knowledge in the properties of drugs, I proposed a little cold camomile-tea two or three times daily, and one glass of wine to be sipped at dinner. The remedies being of a simple nature, and the mother professing a great horror of drugging her children unless she did it herself, the plan was acceded to, and in the course of ten days the patient was quite restored to health. It is not the continuance of a white tongue which should authorise a novice to persist in the use of such a remedy. Slight gastric affections may be very much increases by doses of calomel, and I am mistaken if I have not seen the infantile remittant fever produced by this harsh remedy, where the bowels have been in a tender and sensitive state; I am certainly not mistaken in believing that this fever has been much aggravated by large doses of calomel at its commencement. This drug is an invaluable remedy in infantile diseases, but its indiscriminate use has brought it into disrepute, and hence the difficulty which many professional men experience in controlling the prejudices of matrons who resist its administration where it is often most indicated. There is a prejudice that the teeth in after-life are often spoiled by the taking of mercury in the earliest periods, but it is not always remembered that there are two crops of teeth, and how much soever it may be blamed for its action on the deciduous ones, it must be innocent of any damage done to those which appear many years after its use has been discontinued. It is hardly fair to tax it with this result when many men at the age of fifty possess sound and entire teeth, who have undergone several courses of mercury after the adult age, whose teeth have shaken in their sockets for a time, but have again been fixed tight, and present a fine enamel front in spite of such disasters.

"JAMES'S POWDER

"Is much less patronised by the *non idonei* than it was formerly, when it was given as a

* M. Trousseau carries the dose of iodide of potassium to from 1 to 3 grammes per day. [The gramme is about 15½ grains English.]

panacea for most ailments. Its supposed virtues consisted in its equally-supposed powers of producing perspiration, and upon a fair investigation of its merits in this one particular, no medicine has less sustained its reputation. There are some excellent remarks of Dr. Holland, in his 'Medical Observations upon the Use of Sudorifics,' where he has advanced the impotency of this preparation or its synonym, the antimonial powder, in effecting this desideratum, and perhaps the profession generally have been as much disappointed in their expectations of what James's powder seemed to promise as in any of the whole catalogue of chemical specifics. Who was not recommended its use at bedtime, with the adjunct of feet in warm water, to stop an incipient catarrh by means of relaxing the pores, and who has not been frustrated by the non-performance of what he vouched for? It is a question, as Dr. Holland observes, if sweating, produced by artificial means, is often critical—Hippocrates has said that it never is so in fevers; but if this be the end in view, there are more certain means in accomplishing it than by James's powder, which, if it perform it, does so for the most part indirectly, by exciting vomiting. The same objection may be made to its indiscriminate use as to calomel, that it is not indicated in many cases where it is administered, and may tend to increase the irritation which it was given to alleviate. If the purpose for which it was employed be not effected, it must do harm, for medicines are not nugatory when introduced into the system, and it is the only and great advantage which the Homœopathists have over regular practitioners, that their patients are satisfied with the idea that if their doses do no good, they can do no harm. They may refute this assertion, but with the public it is the corner-stone of their belief.

"The hot skin, the headach, the languor, indicative of infantile gastric irritation, are only aggravated by injudicious doses of James's powder, and, where a few leeches applied to the pit of the stomach, some warm fomentations, and some saline medicine, would have put a stop to more serious disease, the time, perhaps, has been allowed to elapse in seeking for relief by the administration of this nostrum.

"ANTIMONIAL WINE

"Is frequently given to children most injudiciously, with the intent to make them vomit. A child is probably laboring under gastric affection, and throwing up everything from increased sensitiveness of the stomach, which requires sedative treatment, whilst this natural disposition to sickness is looked upon as an indication that nature is seeking relief in this manner, and requires assistance. The irritation of the stomach is only much aggravated by such proceedings, and matter furnished for more serious disease.

"In giving antimonial wine to children, when the object is legitimate, it is sometimes found to be inert, and the mother is afraid to increase the dose; a little lemon-juice or vinegar will be certain to produce the effects, as it disturbs the coat of mucus with which the stomach of children is lined, sheathing it against the action of medicine. Nurses observe that acids cut the phlegm. The same observations apply to adults as to children as regards exciting vomiting artificially in cases of peculiar irritability of the gastric organs. What is styled the sick bilious headach is seldom relieved by this means, and as the term bilious is misunderstood, so the apparent proofs of the existence of bile in the system are equally a misconception. In the operation of vomiting, if the action be severe, the bile is pressed out of its ducts and reservoir into the stomach, where it flows naturally for the purposes of stimulating the intestines to their ordinary action, and is thrown up at once, constituting the fact that the patient is bilious. Now, a certain quantity of this fluid is necessary for the performance of the digestive functions in their more extended sense, and this dislodgement of it from its natural reservoirs may be anything but salutary. It is only in cases where there is a superabundance of this fluid that relief is to be found in vomiting, and that the complaint can come under the denomination of bilious. This is a mistake which is too frequently made, the appearance of a yellow fluid, and the bitter taste in the mouth, are positive proofs of the existence of bile, and this is considered the cause of all the ailments, and of the rationality of the practice. It may justify a repetition of the emetic and a dose of calomel as a *finale*, and the matron usurps the title of the decided practitioner.

"If it were understood that a certain quantity of bile were necessary to health, and that this may be dislodged by vomiting whenever violent action is excited, it would lead to a more clear conception of the term bilious, which has been the occasional source of mischievous interference.

"Emetics are very useful and effectual agents in arresting the progress of several diseases, and none more so than that of the influenza, which seems to have located itself in this country for some years past. It prevailed most severely, but not fatally, in St. Petersburg, in 1838, and for some days there was a complete suspension of all social

recreation. Everybody seemed more or less under its influence, and such was the demand for medicines at the druggist's shop, that the men were employed night and day in dispensing, and still unable to serve their customers. It made its attack in the most sudden manner, and without any warning. Some would complain of a sudden pain in the head, like a shock of electricity; others were seized suddenly with a *courbature*, as the French style it, or pains of lumbago; some with a trembling in their knees and legs; some with dyspnœa and sense of suffocation, and all these symptoms as preludes only to the affection of the vocal and respiratory organs. I was attacked by the complaint at its onset, and very severely, being seized simultaneously with three other people in the same room in perfect health at the time, and in a few hours all were prostrate. As soon as we had parted I took a powerful emetic, and followed it up with some calomel and colocynth, which treatment cut the disease short, and allowed me to render assistance to many who were in the same predicament. In all cases I employed emetics, equal parts of antimonial and ipecacuanha wine, and in all cases where this was adopted upon the first symptoms manifesting themselves, it was almost always effectual. Where some days had elapsed, during which the patients had been treating themselves by taking emulsions, sedatives, &c., the vomiting produced no longer the same effects; these cases dragged on to indefinite periods. So fully did this treatment answer that I left prescriptions with all the families whom I was in the habit of attending, for emetic potions, and requested any member who should be suddenly threatened with the attack to take the emetic first and send to me afterwards, for during this epidemic it was difficult to find the practitioner when he was wanted, and several hours might elapse before assistance was afforded. This was obviated by the plan which I have detailed. I have not had many opportunities hitherto of ascertaining whether the same most beneficial effects are promised by the adoption of the same means in combating the influenza in this country. I should fearlessly recommend their use, not but that I am aware that all diseases, as well as the means of combating them, are influenced by the climate in which we find them prevail.

"DIAPHORETICS.

"It has been said that the far-famed James's powder does not always produce this effect where such is a desideratum. As the means of producing diaphoresis are sometimes within the reach of simple ptisanes, and as in general the attempt is made to perform this operation in cases of sudden cold, or in catarrh, no risk attends the practice; it may be left to the discretion of the matron under most circumstances. There are some simple infusions used on the Continent which answer this purpose very well. The flowers of the elder-tree have considerable sudorific power, but a more decided diaphoretic is found in the wild raspberry, which, when dried and made into tea, is effectual to this purpose. A basin of this, when going to bed, is a certain specific with the Russians for curing a slight cold. It is frequently too much an object, even with some practitioners, to produce perspiration artificially, which never affords the same relief to the patient as when nature unlocks the pores. That delightful sensation which, after two or three nights previous restlessness and feverishness, the body experiences, when waking from a short and unexpected slumber it is bathed in moisture, and all uneasiness has vanished, so that it immediately relapses into long and sound sleep, is never produced by artificial means.

"The Dover's powder has lost much of its former reputation as a sudorific, and strict analysis of its composition does not prove that much virtue is to be ascribed to any but the principal ingredient, opium, which, given *per se*, in form of a pill, would, perhaps, have better answered the purpose. It is no uncommon complaint against this preparation, when given in form of powder, that it did not answer the intention, because it produced vomiting, and many delicate stomachs cannot resist the intense bitter of the opium in solution. The late Dr. Birkbeck denied its diaphoretic powers upon chemical principles, and finding the disadvantages above mentioned attending its administration, ceased to employ it during many years of his practice, anticipating more certain effects from the combination of opium with more decided sudorifics. In respect to its use as a domestic medicine, the circumstance that it is a preparation of opium forbids its employment by inexperienced hands. Such must be contented to prepare the posset, the whey, the elder-flower, and raspberry tea. There is no better way of exciting the skin to action than by the vapour-bath, and this may be accomplished by a very simple process. A common tin or copper *cuve* answers the purpose very well. It is only necessary to put a heated brick into it at the foot extremity, and pour cold water upon it; the upper part must be covered over by a flannel covering, to prevent the steam escaping, which falls

upon the body underneath ; the head may be popped out from time to time, for respiration sake, but a few minutes of this discipline will generally produce the desired effect. It is particularly manageable for children, and does not require all the preparations which more elaborate means demand ; for in this country, which is still behind hand in these matters, the preparations for a bath come under the denomination of what the French term *une histoire*.

"In cautioning matrons against usurping too much of the practice of medicine, it is not an object to alarm them unnecessarily, nor can we hesitate saying that many are capable of judging of the propriety of treating their children for slight ailments. It is with no intention of giving a premium to the apothecary that such warnings are thrown out. It cannot be denied that serious cases have, by injudicious treatment, been so manufactured, and that mothers have reproached themselves sometimes too severely for taking too much responsibility upon themselves. Goëthe, in his second part of Faust, throws out a hint of very general application in all such matters :—An amateur, delighted with the wonders performed by the philosopher's stone, resolved to purchase it at whatever price. It was ceded to him. To his dismay he could do nothing with it. It was but a common pebble in his hands. He applies to the philosopher, by whom he supposes himself to have been cheated, in having palmed upon him a spurious mineral. The former owner convinces him of the contrary by taking it out of his hands and performing the wonted feats with it. The man, amazed, asks the reason why it will not do the same for him ? 'For the simplest of all reasons ; you are not the philosopher to manipulate it, and the stone can do nothing of itself.' It is the experienced hand, therefore, that can hope for beneficial results in its choice, and manipulation of powerful remedies."

SIR JAMES GRAHAM'S MEDICAL REFORM BILL.

To the Editors of the Chemist.

Gentlemen,—

At length this long-promised measure has been brought forward to be discussed in the next session of Parliament, giving the medical public some six months to consider it's provisions. Already has the tocsin of alarm been sounded, and the profession had numerous meetings to oppose the Bill. There is no doubt but the measure will be successfully battled with, and the Ministers defeated, if the Profession only act with energy and combination. It is obvious that it is not based on sound and liberal principles, and therefore must fall ; there are, however, points which manifest a right sort of spirit, but they are few—such as repealing certain old statutes which were enacted for the special benefit of the Royal College of Physicians in the semi-barons reign of Henry the 8th ; also repealing the Apothecaries' Act of 1815, giving them, as a body, certain obnoxious powers and privileges.

But, Gentlemen, as regards the chemists and druggists, the Bill is altogether silent ; it leaves that body precisely as they are constituted now—nor does it classify and separate the profession into different heads, defining their respective positions, from the physician down to the humble druggist, who ought to be the sole dispenser of medicine. Neither does the Bill guarantee the public against the empiricisms, or the sale of drugs by unqualified persons. Here is sad remissness as regards Sir James's care for the public health ; for these parties there ought to have been stringent clauses for full protection of the public, as well as justice toward those who have been properly brought up to a knowledge of medicine ; such, at least, in my humble opinion, ought to be embraced in a Bill purporting to be "a Bill for reforming the Medical Profession."

I am, Gentlemen,
Yours, respectfully,
Sept. 17, 1844. Patrioticus.

CAMPHORATED SAPONACEOUS SPIRIT, OR LIQUID OPODELDOC.*

BY GISEKE, OF EISLEBEN.

For several years, this spirit has not only been prescribed by the physicians of Eisleben, under the name of liquid opodeldoc, but it has also been in public demand more frequently than the ordinary solid opodeldoc. It justly deserves to be preferred to the latter, because it is better preserved than in the flasks which contain it, and because it is more easily applied ; it may also be more easily associated with other preparations when necessary. The following is the mode of preparing it :—

℞ White and dry castile soap.....	60
Camphor	15
Highly rectified spirit of wine.....	500
Volatile oil of thyme	4
Volatile oil of rosemary	3
Liquid caustic ammonia	30

Mix and dissolve S. A., then filter.

* *Archiv der Pharmacie.*

OINTMENT OF MERCURY AND BELLADONNA.*

BY DR. MIGNOT.

℞—Double mercurial ointment 30
Extract of belladonna .. 4
Aqueous extract of opium 1
Liquid balsam of Peru .. *q. s.*

Mix and F. S. A. an ointment of ordinary consistence, and perfectly homogeneous.

This preparation is indicated in cases of hœmorrhoïdal tumors, whose pains it calms with much success.

More or less numerous applications are made according to the cases.

The dose in which it should be employed necessarily varies according to the size of the tumors, on the surface of which it should be applied.

MEDICAL REFORM.

Sir—

Thinking it would be a serious loss to the world (particularly to the medical profession) if the enclosed was allowed to remain in obscurity, I have taken the liberty to forward it to you, hoping you will give it an insertion in your useful and valuable *Journal*, from which I think we may see reform is wanted amongst M.D.'s as well as the poor plebeian chemists and druggists.

Yours, obediently,
Hull, Sept. 9, 1844. H. D. T.

℞—Bicarb. Potass., ʒi.
Sesqu. Carb. Soda, ʒij.
Tr. Opii, M 50.
— Hyocyam., ʒiss.
— Gent. C. ʒij.
— Z. Z. ʒij.
Cito. ferri, ℈iss
Liq. Arsenic, M 30.
— Ammon., M 40
Ex. S. Sarsa., C ʒi.
Aq., ʒvss.
Hs. Cochl. ij. *pan* bis in die ex. aq.
℞—Morph. Men., gr. ij.
Quin. disulph., gr. iv.
Pulv. Capsici, gr. vj.
Ex. Conii, ℈i.
Ex. Hyoscyami, gr. x.
Carb. ferri. Sacc., ℈j.
H. ft. Pil. 24, capt. j. bis in die.

W. G., M.D.

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* *Journal de Chimie Médicale*, July, 1844.

ON THE DIFFERENT KINDS OF CALCINED MAGNESIA EMPLOYED IN MEDICINE.*

BY M. MIALHE.

It is in consequence of some remarks published concerning an *advantageous formula for employing magnesia as a purgative*, which I last year inserted in the *Bulletin de Therapeutique* that I have been led to make the chemical and therapeutical observations concerning the varieties of oxide of magnesium found in pharmacy, which I now make public.

The following is the formula in question :—

MEDICINE OF MAGNESIA.

℞—Calcined magnesia 8
Simple syrup 80
Orange-flower water 20

Bruise the magnesia carefully with a little syrup, and, when the mixture is perfectly homogeneous, add the remainder of the syrup and the orange-flower water.

Four months after the publication of this formula, M. Gobley, our colleague, was led to prove a chemical phenomena with which I was partially acquainted, but to which chemists had not called attention, namely, the property which recently calcined, that is to say, anhydrons, magnesia posseses, of remaining liquid when in contact with a certain quantity of water, and of afterwards becoming, in the hydrated state, solid after 24 hours' contact.

The consistence which the potions had acquired was due to the solidification of the water by the magnesia, or rather to the hydralation of the magnesia.

However, I would observe that the two magnesian potions which have served for the text of M. Gobley's publication, had been prescribed with a smaller quantity of syrup than that I have indicated in my formula, which rendered their solidification more easy and more prompt. This fact was, moreover, proved by the author.

Although, says he, in this potion the magnesia is in contact with only six parts of water, there was no solidification in 24 hours; this is owing to the large proportion of sugar in the mixture. Indeed, if we diminish the syrup and replace it by an equal quantity of water, the mixture solidifies in 24 hours.

From this, M. Gobley concludes that it will be necessary to prescribe the *medicine of magnesia* with the proportions I have indicated when it is to be taken in less than three days; but that it will be necessary to

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* *Journal der Pharmacie.*

increase the proportion of water when it has to be kept longer.

The following, according to M. Gobley, is the formula of a *draught of magnesia*, which may be kept liquid for an idefinite period:—

℞—Calcined magnesia 8
Syrup of orange flowers .. 30
Distilled water 87

I am now going to point out how it is that I have not observed the solidification of oxide of magnesia in preparing my draughts: and, first, I might remark that the medicine of magnesia belonging to the class of medicaments prepared only when wanted, that is to say, magistral medicaments, I had not attended to its conservation; but I can make no such excuse. Here is the truth. After having theoretically and practically proved that the presence of sugar in the magnesian draught greatly augments its efficacy, which, to me, was indisputably established some time before the publication of my formula, I made some experimental investigations to ascertain whether all the varieties of calcined magnesia were equally adapted for suspension in syrup; if all were equally miscible in that vehicle, and I soon ascertained that the light variety of calcined magnesia is best adapted for preparing the purgative draughts having oxide of magnesium for their base. Moreover, experience taught me that all the varieties of light calcined magnesia are not equally fit for employment in the preparation of *white medicines*. That which appeared to me to succeed the best, and to which, consequently, I give the preference, is a variety of oxide of magnesia generally well decarbonated, very white, which has been very common in commerce for some years, and which is said to come to us from London.

The medicines of magnesia prepared with the English calcined magnesia, of which I have just spoken, present the form of a white and very homogenous liquid, of the consistence of a clear syrup, and *may be kept liquid for an indefinite period.*

What was my surprise, after this description, to learn that the magnesian draughts prepared by M. Gobley, had presented to him totally different physical properties!

To what could the differences of our results be owing?

Was it to the chemical nature of the oxide of magnesia employed by me?

But my magnesia was pure; it did not contain even appreciable quantities of carbonic acid.

Was it due to the presence of a certain quantity of water which the English decarbonated magnesia might, perhaps, contain?

I thought for some time that it must be thus, being convinced by analysis that this English magnesia really contained water, that it contained as much as 20 per cent. of its weight, that is to say, one-fifth.

However, it was not to this that the difference of the results was owing; for, having prepared a hydrate of magnesia similar to that of London, and having prepared with it a *medicine of magnesia*, the latter acquired, after several days, a consistence incomparably greater than English decarbonated magnesia takes under the same circumstances.

I wish for a moment to call the attention of practitioners to the intimate nature of the light calcined magnesia which comes to us from London, and which I will designate under the name of hydrate of magnesia, or better still under the name of *slaked magnesia.*

HYDRATED OR SLAKED MAGNESIA.

This commercial variety of decarbonated magnesia is very white, very light, very soluble in the acids, and contains little or no carbonic acid. It always contains a very great quantity of water, varying in proportion from 12 to 20 per cent., as I have ascertained by experiment.

For some time I thought that I was the first to prove the presence of water in light English calcined magnesia, but I hasten to declare that this is not the case. M. Dubail, in his excellent *Inaugural Thesis*, has devoted an article to it, from which I will quote some passages which leave nothing to be desired:—

"For some time decarbonated magnesia has come to us from London, it appears, which is sold at a lower price than it can be manufactured for here, whatever economy be used.

"This magnesia is rather lighter than ordinary calcined magnesia; it dissolves like it, and more easily, without effervescence, in the acids. It gives no indication of any foreign base—it is therefore regarded as pure; but, when calcined, it loses 20 per cent. of water."

What is the true nature of this variety of decarbonated magnesia? I had presumed for an instant that this oxide of magnesium should constitute a hydrate in definite proportions; the same idea occurred to M. Dubail, but I was very soon convinced of the contrary; it is a mixture of hydrate and non-hydrated oxide; it is a hydroxide in variable proportions.*

By what process has this decarbonated magnesia been obtained?

This calcined magnesia has certainly been prepared by the ordinary method, namely, by the calcination of the hydrocarbonate;

* The true hydrate of magnesia contains 30 per cent of water.

but it has afterwards been exposed to the damp air for a more or less long time, or it has been purposely exposed, which is probable, or it has accidentally become exposed during the journey; however, by exposing recently calcined magnesia to humid air, I have produced, in two or three days, an hydroxide of magnesia in every respect similar that which comes from London, and capable of replacing the latter in the preparation of magnesian draughts, which is not the case, as I have already said, when hydroxide of magnesia has been instantaneously prepared.

Nothing is now more easy than to give an explanation of the different properties which the two varieties of hydroxide of magnesium just mentioned, present; there is between these two compounds the same difference as between lime spontaneously slacked in the air, and lime suddenly slaked by a sufficient quantity of water. Every one knows that the latter alone can be employed in masonry, because it alone is susceptible of producing solidifiable mortars. Is it necessary to observe that lime spontaneously slaked in the air is analogous to English hydroxide of magnesium and that ordinary slaked lime is analigous to hydroxide of magnesum, prepared immediately? No; doubtless. But, perhaps, it will be asked of me, how do you conceive that magnesia can be hydrated in the air, without evidently absorbing carbonic acid? This is, because it is not true that oxide of magnesium has as much affinity for this acid as chemical books would lead us to believe; it is because this metallic oxide has a much greater affininity for water than for carbonic acid. Its affinity is even so small that calcined magnesia, kept in a dry place, may be preserved in tact for several years, as I had an opportunity of proving, in 1829, at the *Pharmacie Central*, in concert with M. O. Henry. I will say more: having passed a current of carbonic acid over dry oxide of magnesium, the proportion of carbonic acid absorbed was entirely inapplicable. Thus, it is certain, that calcined magnesia has a much greater affinity for water than for carbonic acid; it is quite as certain that this base absorbs carbonic acid only after having passed to the state of hydrate, and that, even then, this absorption is infinitely less than had previously been supposed. The same phenomenon is presented with lime; this base has also a greater affinity for water than for carbonic acid. This explains how it occurs that we never find the lime in mortars saturated with carbonic acid, however old they may be, as M. D'Arcet has proved.*

*Annale de Chimie et de Physique, t. 74, p. 325.

There is between lime and magnesia an analogy of chemical actions, which has not sufficiently attracted the attention of chemists, and which has long been impressed on my mind. The following is what I said of it in 1828, in my little work on the solidification of balsam of copaiba by magnesia:—

"It is necessary to prolong the calcination of the magnesia until this metalic oxide is almost insoluble in the acids; in this state its causticity is extreme; put on the hand, it burns it almost as promptly as oxide of calcium."

Thus, then, it is to my mind indisputably demonstrated that there exists between magnesia and lime an extremely great analogy of chemical properties. There is a caustic magnesia, a quick magnesia, as there is a caustic lime and a quick lime; and there exists a slaked magnesia, just as there exists a slaked lime.

The chemical considerations which I have just made known, which are not very important at first sight, acquire a different interest when examined in a therapeutical point of view; this is because caustic or quick magnesia, and hydrated or slaked magnesia, present very different medical properties.

Caustic magnesia, like caustic lime, can never be employed in medicine, at least in a high dose; but, on the other hand, it is the only preparation of magnesia suitable for solidifying balsam of copaiba. I know that several samples of balsam of copaiba have been unjustly regarded as bad, and discarded as such, and this because the magnesia employed for testing it was hydrated, and consequently, improper for the purpose.

The following is my reason for saying that caustic magnesia should never be employed in a high dose:—First, because it is more difficultly soluble in the acids of the stomach than hydrated magnesia, but especially because, having the property of combining with water, of being able to solidify ten times its own weight, it results that when it is introduced into the stomach in a large dose, from 8 to 16 grammes, for example, this oxide appropriates to itself the liquids contained in that organ, renders them solid, dries the mucuous membrane, which is found in some measure masticated by the hydrate of magnesia produced in this case. Hence the explanation of the thirst which always more or less accompanies the administration of a large dose of caustic magnesia; hence also the explanation of that pinching, of that species of organic tenesmus which the patients always suffer when they neglect to drink large draughts of water after swallowing it.

This pathological state, occasioned by

the employment of caustic magnesia, is so marked in certain persons that they are forced to suspend its use.

Thus, for example, I have, from Dr Emery, the calcined magnesia, which he has been obliged to renounce on account of the indisposition caused by taking it, and to substitute for it the hydrocarbonate, which did not produce the same effect. Which difference of action that skilful practitioner explains by admitting in anhydrous oxide of magnesium the presence of a certain quantity of caustic alkali, potassa, or soda in the free state, but which is very certainly attributable to the magnesia itself.

From the foregoing, it indisputably results that practitioners will do well to renounce the use of recently-calcined magnesia, and to substitute for it, not the hydrocarbonate of the shops, but, indeed, hydrated or slaked magnesia, that is to say, the hydroxide of magnesia obtained spontaneously in the air, like that which comes to us from England. Now, although a slight variation in the dose of a substance is innocent, as magnesia cannot bring about any bad result, it is, however, more rational to adopt the medical employment of magnesia in invariable proportions; that which appears to me to combine all the desirable conditions, that which especially, is most convenient for preparing purgative draughts of magnesia, well lies, and very homogenous, is that formed of 4 parts of oxide of magnesium, and 1 part of water. This hydrate will, therefore, be designated under the name of magnesia hydrated to one-fifth, as magnesia slaked with one-fifth.

The hydrate of magnesia of which I speak is, I repeat, best suited for the preparation of the medicine of magnesia; and, as in this respect, I give it an exclusive preference over all other varieties of calcined magnesia. The following is my formula for this kind of medicine:—

MEDICINE OF MAGNESIA, OR WHITE MEDICINE.

℞ Magnesia hydrated to $\frac{1}{5}$	8
Sugar syrup	80
Orange flower water	20

This medicine should be taken at one dose in the morning, fasting, and immediately after its administration half a glass of cold water should be drunk, but not more, experience having taught me that taking too much liquid weakens its purgative action, which is owing to a portion of the magnesia passing the pylorus, and, consequently, escaping the solvent action of the acids of the gastric juice and the lactic acids, produced by the stomachal digestion of the sugar.

The medicine of magnesia, prepared according to my formula, is more active than that obtained by the following, the formula which M. Gobley has proposed to substitute for it, as I have ascertained by clinical experiments, which is, doubtless, owing to the latter containing an infinitely smaller quantity of sugar.

These effects of the medicine of magnesia are constant; it is only in a few subjects enfeebled, and incapable of supporting any nourishment that I have known it necessary; it is the purgative of people who digest. This purgative ordinarily acts only five or six hours after it is taken, rarely after, more rarely before.

As the action of the magnesia is slow in appearing, it is well to observe here that it is not necessary to await its effects to take food; it may be taken, without inconvenience, three hours afters its administration.

ON THE EMPLOYMENT AND ACTION OF DIGITALIS IN CERTAIN DISEASES OF THE HEART.*

BY WILLIAM HENDERSON, M.D., PROFESSOR OF GENERAL PATHOLOGY IN THE UNIVERSITY OF EDINBURGH.

A REMEDY so long and so habitually resorted to, and so much prised, in the treatment of diseases of the heart, as digitalis, may be supposed to have been so thoroughly studied, and to be so well understood, in all its therapeutic capabilities, as scarcely to afford occasion or ground for remarks having any pretension to novelty or importance; and yet, a glance at the opinions which are entertained of the manner in which its benefits are effected, and at the indiscriminate and almost universal recommendation of it in organic diseases of the heart, suffices to prove that something may still be added to the history of its operations, not unworthy of being known. Or, perhaps, the matter may be more correctly stated in a different way, so as that, while it may be granted that the effect which digitalis produces on the heart is thoroughly understood, it may be still questioned whether the manner in which different diseases of the heart are influenced by that effect has been duly considered or recognised—a mode of putting the case which would make the proper title of this communication, "The action of different diseases of the heart under the influence of digitalis."

Passing by the alleged temporary accelera-

* *From the Northern Journal of Medicine.*

tion of its contractions, the heart may be said, in general terms, to have the frequency of its motions lessened by digitalis. Such being the case, it will hardly surprise any one who is sufficiently acquainted with the very signal changes which some diseases of the organ produce on its construction as an hydraulic machine, that a frequency of its action, which may be advantageous in certain conditions of it, may be very much the contrary in others; and yet the important inference which may thus be demonstrated by morbid anatomy, is almost universally overlooked in practice. My attention to this circumstance was first suggested by Dr. Corrigan's excellent paper, in the *Edinburgh Medical and Surgical Journal*, on Permanent Patency of the Aortic Valves. That judicious physician had noticed that the employment of digitalis was not so generally useful in that as in most of the other diseases of the heart, and my own subsequent experience and observation entirely concur with his. I do not mean to say that very notable advantage is not derived from digitalis in permanent patency of the aortic valves, but that beyond a certain degree its characteristic operation is so much less beneficial than in the other diseases of the heart in which digitalis may be employed, or is actually so injurious, that it becomes a highly important practical rule to abstain from the prolonged or repeated administration of it in the disease in question.

Potency of the aortic opening, at that period when the ventricles are being filled, necessarily admits of regurgitation from the aorta, the effects of which are an overloading of the left ventricle, and gradually an enlargement of it—an enlargement so great ultimately, if the patient survive long, as to exceed, often to a great degree, that which occurs under any other circumstances. The greatest enlargement of the heart I have seen, larger than any other on record, was the consequence of permanent patency of the aortic opening. All the chambers of the organ had become affected with excentric hypertrophy, and to so great a degree that the weight of the empty heart amounted to thirty-six ounces two drachms and a half—above four times the average weight of the healthy heart. Such being the tendency and issue of that overloaded condition of the organ, which results from regurgitation from the aorta, it will be granted that whatever increases the amount of the regurgitation must accelerate the progress of the enlargement. That the less frequently the heart beats, the greater will be the opportunity for this regurgitation, is sufficiently obvious; and hence it is that the prolonged employment of digitalis cannot but be injurious when the aortic valves are not competent for their office. To the consideration of other expedients, common in the ordinary treatment of organic diseases of the heart, yet unequivocally improper in this, I may advert on a future occasion, and shall content myself at present, in reference to what has just been stated, with saying that, if true to the extent to which I believe it to be true, its importance is very much enhanced by the facts that permanent patency of the aortic valves is one of the most common of the valvular diseases of the heart, and is, perhaps, the most easily distinguished during life.

What *à priori* discernment and practical observation concur in showing to be disadvantageous in the disease which has been specified, is capable of being proved by the same means to be eminently useful, in some other diseases of the heart, and in none more than in those of the left auriculo-ventricular opening. To these I confine my further remarks for the present.

Diseases of this opening, although of several kinds, produce but two sorts of effects on the circulation;—either, by merely narrowing it, hindering the transmission of blood from the left auricle into the ventricle, or, by rendering the leaves of the mitral valve insufficient to close it, while the ventricle is contracting, admitting of a regurgitation of blood into the auricle. When either of these occurrences amounts to a considerable degree, and is of long continuance, hypertrophy of the right ventricle supervenes, and then it is that the sufferings from dyspnœa are developed, and that dropsical effusions are apt to take place. The circulation through the heart is materially impeded, and the lungs,—partly from this cause, and partly from the augmented power of the right ventricle,—placed as it were between two fires, become overloaded with blood, and distressed with the sense of suffocation. And not only so, but the whole venous circulation becomes retarded, and congestions occur in the distant viscera. Superadded to the mere mechanical imperfections which result from the diseases of the opening, and the hypertrophy of the right ventricle, an increased frequency of the actions of the heart very commonly attends, either as a permanent occurrence, or as an occasional event dependent on bronchitic attacks, and usually, in proportion to this frequency are the distress from dyspnœa and the amount of the dropsy. Those who are familiar with valvular diseases of the heart must have remarked that a very moderate amount of bronchitis is enough to excite much suffering from what is called

difficulty of breathing, but it is certainly not usual to find this ascribed to its true cause. Impeded transmission of air into the cells of the lungs is commonly considered the source of the evil, though the dyspnœa is often very great without there being any stethoscopic evidence of such impediment; and, that I am right in ascribing it rather to the increased frequency of the actions of the heart, appears from the facts that mere muscular exertion, by increasing that frequency, suffices to produce or to aggravate the dyspnœa, and that a diminution of that frequency, through the instrumentality of digitalis, suffices to lessen or to remove it. The reason why an acceleration of the pulses of the heart excites or increases dyspnœa and dropsy in the diseases of the left auriculo-ventricular opening is twofold. In the first place, it does so on account of the hypertrophic condition of the right ventricle, and, in the second, on account of certain occurrences of the diseased opening. Thus, when there is narrowing only of that opening, the more frequent closings of the valve cause a more frequent interruption to the onward motion of the blood; and, when there is a patent state of the opening, a more frequent regurgitation, and a greater amount of it in proportion to the quantity of blood which has had an opportunity of passing into the ventricle. Such being the natural effects of an increase in the frequency of the actions of the heart, it is easy to understand how a diminished frequency operates in relieving the disorders which attend on the diseases which have been referred to. This operation is useful in several ways; it moderates the force with which the blood is propelled into the lungs, and, by the lengthened interval between the contractions of the heart, it allows of the left ventricle being more fully distended in the case of the narrowed opening, while it lessens the frequency of the interruptions to the passage of the blood, and, in the case of patency of the opening, prevents the regurgitation from being so often repeated. That these latter circumstances are not visionary, but real and efficient, is manifested by the great change which is witnessed in the size and force of the pulse at the wrist when the digitalis has produced its full effect on the actions of the heart. From being very small and feeble before the digitalis has been administered, the pulse becomes full and firm when the medicine has reduced the number of the contractions of the heart to 40 or 50 in the minute. Coincident with this change, other important improvements occur. The respiration becomes freer and easier, the amount of urine increases, and the dropsy begins to disappear; improvements which are due to the bettered circulation through the heart, and the consequent diminution of those mechanical congestions which had embarrassed the lungs, and hindered the action of the kidneys. In illustration of these views I subjoin two cases, the one of narrowing of the left auriculo-ventricular orifice, the other of regurgitation through it, and both with hypertrophy of the right ventricle. It will be seen that in each, as the heart beat more slowly, the amount of the urine increased, and the dyspnœa and dropsy diminished. At first, for a few days, in one case, squill and bitartrate of potassa were conjoined with the digitalis for the purposes of securing a diuretic effect with more certainty; they were speedily omitted, in order to show the pupils of the hospital the action of digitalis alone. I took the opportunity of stating, that I did not conceive the digitalis to act as a diuretic, in the common sense of the term, by augmenting directly the functional activity of the kidneys, but indirectly in consequence of its lessening or removing the venous congestion of these organs, in common with that of other viscera, in the way I have described. At the same time it was stated, that digitalis has been conceived to have the power of increasing the secretion of urine by a more direct influence, perhaps a stimulation of the kidneys, since it has appeared to augment the quantity of urine sometimes in healthy persons, and has been known to produce a similar effect upon other secretions, occasionally to a very considerable degree—on the saliva for example. But that in the cases in question the medicine could not be supposed to have acted in this way, but in that which I have detailed above, appeared to be proved by the continuance of the copious secretion of urine so long as the effect of the digitalis continued to be exerted on the heart, many days after the drug had been omitted; and by the decrease in the amount of urine which occurred when the action of the heart rose to its previous frequency.

Case 1.—Narrowing of the Left Auriculo-ventricular Opening.

Mary M'Donald, a widow, aged 60 years. She was admitted into the Infirmary on the 19th of February last, and fell under my care on the 29th of that month. It had been ascertained that twelve years before her admission she had been affected with severe pain in the chest, for which she was bled and blistered, and that since that time she had enjoyed on the whole good health until about six weeks before her admission, when, as she thought, in consequence of exposure to cold,

she became affected with dyspnœa and cough. She had been previously sensible of occasional palpitations of the heart, and about the time at which she began to suffer —but whether after the dyspnœa came on or not was not ascertained—she became affected with general dropsy.

The report of the 29th of February is as follows :—The sternum is prominent, the corresponding cartilages of the ribs not so. The percussion-sound is pretty good in front, beginning to be dull in connexion with the heart between the third and fourth left cartilages, and laterally on the right side of the lower third of the sternum, from which the dulness extends two inches to the left of the bone. The respiratory murmur is superseded a little by mucous rattle on the right front. The percussion-sound is dull on the left back inferiorly, nearly from the lower angle of the scapula, but is moderately good on the right. The respiratory murmur is absent over the dull space on the left. Pulse at the wrist very feeble and irregular; in the region of the heart not particularly strong. At the wrist the pulsations amounted to 56 in the minute, and in the region of the heart to 72. She has much dyspnœa; respirations 26. The report on the 1st of March is to this effect :—Urine amounts to 10 ounces, is loaded with red sediment, and has a density of 1023. Pulse in the region of the heart is 104, at the wrist 58. It is very feeble and small, but pretty regular, in the latter situation. Sounds of the heart are free from murmur. Impulse moderate. On the 2nd she was ordered ten leeches to the sternum, and powders containing each two-thirds of a grain of digitalis, two grains of squill, and ten of bitartrate of potassa, of which one was to be taken every six hours. She had also a draught for the night, containing some muriate of morphia and sulphuric ether. She had at this time considerable œdema of the lower limbs, and a good deal of effusion into the left pleura.

March 4. The urine began to increase on the 2nd, and in the course of the last twenty-four hours has amounted to thirty-six ounces. Breathing easier. Œdema nearly gone.

March 5. About seventy ounces of urine. Breathing much improved. State of left side much as before. Pulse improved in size and strength—at the wrist 56, at the heart 90. All but the digitalis to be omitted, of which a grain thrice a-day.

March 7. Urine 120 ounces. Pulses in the region of the heart 80, a strong followed quickly by a feeble one; at the wrist 56, of fair strength and size, and not very irregular.

On the 11th the pulse was 40 at the wrist, full and firm; and continued from 40 to 42, full and firm, and the urine usually from 30 to 90 ounces, till the 19th, though the digitalis was omitted on the 12th. The pulse began to rise in frequency after the 20th, and on the 1st of April was at 84, the urine amounting to 30 ounces. On the 2nd of April the pulse was 90 — fluctuation and swelling had occurred in the abdomen, and œdema in the lower limbs, and the breathing had become again very difficult—though the effusion into the left pleura, which had disappeared, had not recurred—and the urine had become reduced to 15 ounces. Two grains of nitre and one and a half of squill were prescribed four times a-day, and on the two following days the urine amounted to 24 and 26 ounces. Digitalis in doses of a grain thrice a-day was substituted on the 4th; and on the 7th the urine amounted to 64 ounces, while the pulse ranged between 80 and 92; and on the 10th to 100 ounces, the pulse being 50, of good size and strength. On the 11th of April the pulse was 48, the urine 104 ounces. The influence of the digitalis on the heart appeared to decline afterwards; and on the 15th the pulse at the wrist was 60, small and irregular, in the region of the heart 80, and the urine amounted to but 24 ounces. She desired to be dismissed at this date.

Case 2.—Regurgitation through the left auriculo-ventricular orifice, and hypertrophy of the right ventricle.

Mrs. Blakie, aged 27; admitted into the Infirmary, March 5, 1844. Eight or ten years ago she was very subject to rheumatism, which affected chiefly the lower extremities, but the lesser joints in upper extremities also occasionally. About eighteen months ago she was confined with her first child, the labor was tedious, and required the aid of instruments for its completion. About a fortnight after delivery she had a severe inflammatory affection within the chest, shortly after her recovery from which she was sensible for the first time of palpitations in the region of the heart, greatly aggravated on exertion, and accompanied by a good deal of dyspnœa, and sense of constriction across the chest. Since that time her sufferings have been gradually increasing.

Exertion of any kind, especially that of ascending an eminence, increases her dyspnœa so much as to oblige her to stand still, and produces palpitation of the heart. Her pulse is 90 at the wrist, very small and feeble. The exact extent of dulness in the region of the heart cannot be ascertained, owing to the fulness of the mammæ. It begins, however, fully half an inch to the right of the lower half of the sternum, ascends as high as the third rib on the left side, and extends to the

left beyond its natural limits. There is a strong impulse over all this surface, and also in the epigastrium; and also a strong bellows murmur chiefly in the region of the left ventricle. The second sound of the heart at the lower extremity of the sternum, on the right side of the epigastrium, and also between the second and third left cartilages, is preternaturally clear and loud. Both external jugular veins are very turgid, and have a slight single impulse, synchronous with the contraction of the ventricles. She has had some swelling of the face, lower extremities, and abdomen, for the last three weeks. There is a purplish tinge of the countenance; urine said to be between two and three pounds, but has not been kept; density 1022; distinctly coagulable by heat and nitric acid. A good deal of mucous rattle at the lower part of right lung, where the percussion-sound is not very satisfactory. She is ordered to have two-thirds of a grain of digitalis thrice a-day. On the 10th, the pulse was 80, and fuller; the urine 40 ounces; the breathing easier; and the œdema considerably less. On the 11th, the urine was 68 ounces, of density 1,015, and less coagulable; the pulse 72, and of fair size and strength,—all the dropsical symptoms diminished. On the 12th, urine 48 ounces, pulse 72, of good size and strength. Nausea having occurred, the digitalis was omitted, and she had some squill powder given her for two days. On the 13th, the pulse continued of good size, not exceeding 80,—the respirations were easy, and the urine amounted to 58 ounces. She was dismissed in about a week after, having experienced great relief since her admission. Latterly her complaints were returning, but family circumstances prevented her remaining longer.

NEW MODE OF PREPARING AROMATIC DISTILLED WATERS, IN ORDER TO INSURE THEIR LONG PRESERVATION.*

BY O. SCHNEIDER, OF DRESDEN.

The almost impossibility of preserving several distilled waters, such as those of fraises, tillul, franloises, &c., which it is necessary to distil in summer for the remainder of the year, induced Mr. Schneider to propose the following method, of whose efficacy he is assured by an experience of several years.

This method consists in preparing several distilled waters by means of a spirit prepared in the following manner:—

℞ Fresh fruits or flowers, 2 kilogrammes.
Alcohol at 80 per cent, 1 ,,
Distil S. A.

This operation is repeated with the product of the distillation, and that at two several times, on fresh quantities of substance taken in the same quantities as the first time.

2 grammes of this triple spirit are sufficient for converting 125 grammes of simple distilled water into the aromatic water desired.

The water, thus extemporaneously prepared, may be preserved in bottles. By operating in this manner, we are sure of having, throughout the year, a perfectly identical water, in which the organs of taste can scarcely detect the presence of alcohol, on account of its very minute proportion.

IV. REVIEWS AND NOTICES OF BOOKS, &c.

FAMILIAR LETTERS ON CHEMISTRY. By Justus Liebig, M.D., Ph.D., F.R.S. Edited by John Gardner, M.D.

We are glad to notice the publication of a Second Series of Letters, calculated to confer such great benefits on science and on society, and sincerely hope that they will be widely circulated. We have not time to add more, but subjoin, as an extract, Letter X.:

"The immediate and most energetic cause of all the alterations and transformations which organic atoms undergo, is, as I have already stated in the preceding letters, the chemical action of oxygen. Fermentation and putrefaction manifest themselves only in consequence of the commencement of a process of decay; their completion is the restoration of a state of equilibrium. Whilst the oxygen is in the act of combining with any of the elements of an organic substance, the original state of equilibrium of attraction in all its elements is destroyed, the substance decomposes, resolving itself—all the molecular attractions being again equalised—into a series of new products, which undergo no further change in their properties, unless further causes of disturbance or alteration are brought to operate upon them.

"Although the chemical action which the elements of organic atoms exercise upon

* *Archiv der Pharmacie.*

each other in fermentation and putrefaction balances itself, inasmuch as a state of rest is induced between the attractions of the new-formed products, yet this equilibrium does not exist with respect to the attraction for oxygen. The chemical action of oxygen upon organic substances ceases only when the capacity of the elements to combine with oxygen is exhausted. That action consists in nothing more than the affinity, or tendency of the oxygen to combine with those elements. A perfect equalisation of this tendency, therefore, can only ensue when the elements, by combining with oxygen, have formed such products as are totally incapable of absorbing any additional amount of oxygen. It is only then that the attractions of the elements of organic substances attain a perfect equilibrium with the attraction of oxygen.

"Fermentation or putrefaction represents the first stage of the resolution of complex atoms into more simple combinations: the process of decay completes the circulation of the elements by transposing the products of fermentation and putrefaction into gaseous compounds. Thus the elements constituting all organised beings, which previously to participating in the vital process were oxygen compounds, such as with carbon and hydrogen, reassume the form of oxygen compounds. *The process of decay is a process of combustion taking place at the common temperature*, in which the products of the fermentation and putrefaction of plants and animal bodies combine gradually with the oxygen of the atmosphere.

"No organised substance, no part of any plant or animal, after the extinction of the vital principle, is capable of resisting the chemical action of air and moisture; for all that power of resistance which they temporarily possessed as the bearers of life, the media of the vital manifestations, completely ceases with the death of the organism; their elements fall again under the unlimited dominion of the chemical forces.

"The clearing of the primeval forests of America, facilitating the access of air to that soil, so rich in vegetable remains, alters gradually, but altogether, its constitution: after the lapse of a few years no trace of organic remains can be found in it. The soil of Germany, in the time of Tacitus, was covered with a dense, almost impenetrable forest; it must, at that period have exactly resembled the soil of America, and have been rich in humus, and vegetable substances, but all the products of vegetable life in those primeval forests have completely vanished from our perceptions. The innumerable millions of molluscous and other animals, whose remains form extensive geological formations and mountains, have, after death, passed into a state of fermentation and putrefaction, and subsequently, by the continuous action of the atmosphere, all their soft parts have been transposed into gaseous compounds, and their shells and bones, their indestructible constituents, alone remain.

"It is only in localities, under peculiar circumstances, where the excess of oxygen was limited, or altogether precluded, that we still find distinct remains of primeval vegetables in a state of retarded or impeded decay, as for example, in beds of turf and brown coal.

"The presence of water, and a suitable temperature, are indispensable conditions of the oxidising process of decay, just as they are necessary to putrefaction and fermentation. Perfect dryness, or a temperature below the freezing point, suspends all processes of decay and fermentation. The transmission of decomposition from one particle to another presupposes a change of place; it requires that the particles should possess mobility, or the power of free motion, and this is imparted to them by the presence of water. In decay it is more especially a certain elevated temperature which increases the aptitude of the elements of organic substances to combine with the oxygen of the atmosphere.

"A great number of organic bodies, when in a moist state, are capable of absorbing oxygen, whilst many, and indeed most of them, are *per se* entirely deficient in this property.

"If we place wet saw-dust, or moistened fragments of wood, in a vessel filled with atmospheric air, all the properties of the contained air become in a very short time completely altered. If a lighted splinter—which of course would burn in atmospheric air—is introduced after the lapse of two to three hours, its flame will be immediately extinguished. The air confined in the vessel, if examined, will be found to have lost all its oxygen, and to have acquired an equal volume of carbonic acid gas. If a fresh supply of atmospheric air is made to replace this, the same process again occurs, all the oxygen becomes converted into carbonic acid.

"In the process of bleaching in the open air, or, as it is called, grass-bleaching, we have the process of decay applied to an important purpose in the arts upon a large scale. Linen or cotton textures consist of ordinary woody fibre, more or less colored by extraneous organic substances, which were either contained in the plant whence the fibre

has been derived, or have become mixed with it during the processes of preparation.

"When linen or cotton fabrics are moistened with water and exposed to the light of the sun, a slow process of combustion, or decay, immediately begins upon the whole surface; the oxygen of the atmosphere, in immediate contact with the linen or cotton, is incessantly converted into carbonic acid. The weight of the fabric diminishes every second, precisely because it is in a state of combustion; all the coloring matters gradually disappear, and with them a considerable amount of woody fibre, their elements being converted into oxygen compounds. If this action of air and light upon the linen or cotton continues for a considerable time, these substances lose their cohesion, and become converted into a matter similar to that used in the manufacture of paper, and this matter still continues to decay as long as the essential condition of this change, that is, the absorption of oxygen, proceeds.

"The nitrogenous constituents of plants and animals comport themselves towards oxygen in a manner precisely similar to the behaviour of the non-nitrogenous principle we have spoken of, namely, woody fibre. Fresh meat, as well as the first products of the decomposition of the nitrogenous constituents of plants in fermentation, that is, beer-yeast or wine-yeast, withdraw oxygen from atmospheric air, and, like woody fibre, yield in return an equal volume of carbonic acid.

"When the Cemetery of the Innocents at Paris was removed from the interior of the town to the outside of the barriers, the buried corpses, which had accumulated to a depth of sixty feet, were found to a great extent apparently converted into fat. The substance of the skin, muscles, cellular tissue, and tendons, all the soft parts, and even the bones, had completely disappeared, leaving only the fat, which, resisting longest the influence of decay, remained in the form of stearic acid. This human fat was employed to the extent of many tons by the soap-boilers and tallow-chandlers of Paris, for the manufacture of soap and candles.

"If meat be suspended in running water, or buried in moist earth, nothing of it will remain, after the lapse of some time, except the fat which it contains.

"All substances susceptible of decay, when in a moist state, and exposed to the air and light at the common temperature, undergo precisely the same change as they would if exposed to a red heat, in a dry state, that is, they absorb oxygen—they undergo combustion.

(To be continued.)

SUMMARY OF METEOROLOGICAL OBSERVATIONS MADE AT OTLEY, YORKSHIRE, IN JULY, 1844.

BY E. THOMPSON.

BAROMETER.

Monthly mean	29·73
Mean at 9 a.m.	29·71
,, at 3 p.m.	29·77
,, at 9 p.m.	29·71
Maximum on 20th	30·11
Minimum on 13th	29·19
Range	·92

THERMOMETER.

Monthly mean	58°
Mean of maxima	67
,, minima	49
Maximum on 22nd	76
Minimum on 22nd	45
Range	31

RAIN.—2·49 inches.

WIND.

	Days.		Days.
N.	3	S.	1
N.E.	2	S. W.	3
E.	2	W.	11
S. E.	0	N. W.	5

WEATHER.

	Days.		Days.
Clear	4	Rain	4
Cloudy	10	Hail	0
Overcast	1	Thunder	3
Showers	12	Lightning	0

GENERAL REMARKS.

During this month the barometer has contined at a medium height, and the quantity of rain fallen, though quite sufficient for agricultural purposes, has not been extremely large. Owing to the want of rain in the preceding month, the hay harvest is later this year than usual, being towards the end of the month, just commencing in this part of the country.

NOTA BENE.—*All Communications, Books for Review, and Substances to be Analysed, must be addressed "To the Editors of the Chemist, 310, Strand, London." Communications must be prepaid, and sent before the 15th of each month; Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

ON A NEW OXIDE OF CHROMIUM.*

BY M. EUGENE PELIGOT.

My investigations concerning uranium have led me to study the simultaneous effects of chlorine and charcoal on several oxidised bodies endowed with great stability, and which lose their oxygen only under the combined influence of these two bodies. The Academy will remember that it was this action alone that proved the existence of oxygen in uranium, which oxide was regarded as a simple metallic body.

I propose to make known in this note, in order to take date, some facts relative to the products which result from the decomposition of the green oxide of chromium by chlorine and charcoal: I shall very soon present to the Academy a detailed work on the subject.

It is known that by passing a current of chlorine over a mixture of oxide of chromium and charcoal, a chloride is obtained, which crystallises in beautiful scales of a violet color. This compound corresponds to the sesquioxide of chromium, $Cr^2 O^3$; its composition, as I have proved by new analyses, is represented by the formula $Cr^2 Cl^3$.

But this product is not the only body formed in this operation; its formation is preceded by that of another chloride which appears to have escaped the attention of chemists, and which is presented under the form of very fine white and silky crystals, mixed with charcoal and oxide of chromium; these crystals immediately turn green when exposed to the contact of the air, and are changed in a few moments into a green liquor; they absorb at once oxygen and water from the atmosphere. The analyses which I have made of this chloride leave no doubt concerning its nature; it is composed of 1 equivalent of metal, and of 1 equivalent of chlorine, Cr Cl; it consequently corresponds to a degree of oxidation of chromium hitherto unknown.

This same body is produced when a current of hydrogen is passed over violet oxide of chromium heated to dull redness; hydrochloric acid is disengaged, and a white crystalline mass remains: by operating at a higher temperature, this mass enters into fusion, and presents, after cooling, a fibrous texture. A German chemist, M. Moberg, studied, in 1843, the action of hydrogen on the violet chloride of chromium; however, he misconceived the nature of the compound which results from this action, and which he did not obtain in the state of purity. My experiments on the protochloride of chromium produced by chlorine, oxide of chromium and charcoal, date from 1842, as I can prove by the testimony of several chemists, to whom I at that period communicated the results of my analyses.

Protochloride of chromium, prepared by either of these processes, presents the following properties: put in contact with water, it immediately dissolves; if the water be aërated, and if the operation be performed in the air, the solution is *green;* it is *blue* when the influence of oxygen is entirely avoided.

I know of no body which is more rapidly altered by the contact of oxygen than this compound; thus, in studying its reactions, it was always necessary to operate with water deprived of air by boiling, and in an atmosphere of carbonic acid.

The green solution which results from the action of the air and water on the protochloride of chromium, possesses the singular property of dissolving, with a great disengagement of heat, a considerable quantity of violet chloride of chromium; this latter body, when it is pure, is entirely insoluble in water, and in the acids: this property of the white chloride, which commonly accompanies the violet chloride, when the latter is prepared by the ordinary method, has thrown much uncertainty on the true characters of the latter body, which certain authors regard as very soluble in water, and as producing a green solution, whilst others, with reason, dispute this solubility.

When the protochloride of chromium has been prepared by means of the sesquichloride and hydrogen, it is observed that its

* *Comptes Rendus*, No. 13, September 23, 1844.

solution in water is accompanied by a disengagement of hydrogen; this decomposition of the water, which, moreover, is not very considerable, seems to indicate the existence of a subchloride, resulting, like the subchloride of uranium, from the prolonged action of the hydrogen on the protochloride.

Potassa gives, with the blue solution of protochloride of chromium, a brown precipitate, which is probably the hydrated protoxide corresponding to this chloride; ammonia gives a precipitate of the same nature. An excess of ammonia furnishes a blue solution, which, under the influence of the air, becomes violet, and, finally, acquires a red color.

The monosulphuret of potassium forms a black precipitate in the solution of protochloride of chromium.

On pouring into this blue liquor a solution of acetate of soda or potassa, small red and transparent crystals are immediately seen to appear, and rapidly combine at the bottom of the vessel. These crystals are destroyed when exposed for a few seconds to the contact of the air; but it is possible, by employing the minute precautions which I shall point out in my memoir, to obtain them in a very satisfactory state of purity; their appearance, when they are dry, resembles that of protoxide of copper.

This body is *acetate of protoxide of chromium*, whose composition, according to four analyses which agreed very well with each other, is represented by the formula—

$$C^4H^3O^3, CrO, HO.$$

The determination of the carbon of this salt, which I performed with extreme care, enabled me to submit to a rigorous scrutiny the number which represents the atomic weight of chromium; I have reason to believe that this number is not correct; it is considerably too high. I will, very shortly, communicate to the Academy the results which warrant me in making this assertion.

I have analysed another salt of protoxide of chromium, whose existence, it appears to me, should throw much light on the nature of this oxide; it is a double sulphate of protoxide of chromium and potassa whose composition is represented by the formula—

$$SO^3, KO + SO^3, CrO + 6HO,$$

which is that of a great number of double sulphates. The protoxide of chromium is probably isomorphous with magnesia and several oxides of the same constitution; chromium will present, therefore, the remarkable character of a triple isomorphism, that of its protoxide, CrO, with these oxides; of its sesquioxide, Cr^2O^3, with albumen, peroxide of iron, &c.; of chromic acid, CrO^3, with sulphuric acid.

INVESTIGATIONS CONCERNING A NEW CLASS OF SALTS.*

BY M. E. FRÉMY.

Skilful chemists have carefully examined the action which the oxygenous compounds of nitrogen exert on sulphuric acid. It is to the whole of their works that the present mode of manufacturing sulphuric acid is due.

It is also known that M. Pelouze made known, in his memoir on the *nitrosulphates* the composition and properties of the salts which result from the absorption of deutoxide of nitrogen by the sulphites.

But the action of nitrous and hyponitric acids on the sulphites has not yet been studied. I have treated the question in this memoir; it is connected, as is evident, with the important history of sulphur and nitrogen.

Not to waste the time of the Academy, I will, in this communication, suppress the details of experiments which will be found in my memoir; I propose only to give here the principal characters of the new bodies which I have discovered, and to show their theoretical importance.

When sulphurous and nitrous acids are introduced into a concentrated solution of potassa, these acids are not reciprocally decomposed, as might be supposed, in such a manner as to form a sulphate and deutoxide of nitrogen, but combine, on the contrary, and give rise to a new acid, which contains the elements of sulphurous acid, nitrous acid, and water; and which is consequently formed of oxygen, sulphur, nitrogen, and hydrogen.

I have given to this acid the name of *sulphammonic* acid, which calls to mind its composition and its characteristic property; this acid, in fact, is easily decomposed into sulphuric acid and ammonia.

I will first make known the various processes of preparing the sulphammonates.

The alkaline sulphammonates may be obtained by adding sulphurous and nitrous acids to an alkaline solution; the latter acid is produced, as is known, in the reaction of nitric acid on starch. Hyponitric acid acts in this case like nitrous acid.

Sulphammonates are also formed by mixing two solutions of sulphite and nitrite.

But the best process of preparing these new salts consists in making sulphurous acid react on a nitrite which has previously been rendered very alkaline.

Few salts are prepared with more facility than the sulphammonates; for in a few hours

* *Comptes Rendus*, No. 12, September 16, 1841.

several hundred grammes of crystallised sulphammonate of potassa or ammonia may be obtained.

I now arrive at the examination of the principal sulphammonates.

SULPHAMMONATE OF POTASSA.

When a current of sulphurous acid is passed into nitrate of potassa, the liquor very soon becomes turbid, and deposits long silky needles of sulphammonate of potassa, which is sparingly soluble in alkaline water.

This salt may also be prepared by double decomposition, sulphammonate of ammonia being treated by a salt of potassa.

Sulphammonate of potassa is white, sparingly soluble in cold water; one part of water at the ordinary temperature dissolves only $\frac{1}{60}$. It exerts no reaction on the colored reagents; it has no taste; it presents none of the characters of the salts formed by the acids of sulphur and nitrogen.

The equivalent formula of sulphammonate of potassa causes its principal reactions to be comprehended. This salt is represented by the following formula:—

$$7SO^3\ (SO^2, NH^2),\ 4KO + {}^3HO.$$

It contains, then, an acid which may be regarded as a combination of sulphuric acid and sulphamide.

Some chemists admit that the compounds SO^2, NH^2, may be combined with sulphuric acid to form complex acids; sulphammonic acid is therefore placed in that new class of acids to which MM. Laurent and Persoz have recently called the attention of the Academy.

It was easy to foresee the decomposition which water would cause the sulpammonate of potassa to undergo.

It is evident, indeed, that the elements of water are sufficient for converting it into acid sulphate of potassa and sulphate of ammonia.

This conversion of the sulphammonates into sulphates and into ammoniacal salts, is certainly the most striking character of these new salts. When sulphammonate of potassa is boiled with water for a few seconds, the liquor, which was perfectly neutral, immediately acquires an acid reaction, and contains in solution only acid sulphate of potassa and sulphate of ammonia.

I will speak further on of the decomposition which pure cold water causes the sulphammonate of potassa to undergo. This salt may be preserved for a certain time without decomposition when it is dry; but after a long time, the water of crystallisation which it contains decomposes it into sulphate and ammoniacal salt.

The crystals of sulphammonate of potassa, heated to redness, give all the products of the decomposition of sulphate of ammonia and bisulphate of potassa.

SULPHAMMONATE OF AMMONIA.

The analysis of this salt completely confirms the composition of the salt of potassa. The sulphammonate of ammonia has for its formula $7SO^3\ (SO^2, NH^2)\ 4\ (NH^3, HO)$. This salt is produced in the reaction of sulphurous acid on the nitrite of ammonia.

It is white, much more soluble in cold water than the salt of potassa; it is decomposed, in the same circumstances as the sulphammonate of potassa, into acid sulphate of ammonia. An excess of ammonia gives it fixity.

It serves for preparing, by double decomposition, the salt of potassa, which is precipitated, in this case, in long pearly needles.

The sulphammonates of baryta, strontia, lime, &c., may be prepared by double decomposition; they are sparingly soluble in cold water, and are deposited in a crystalline powder. It is difficult to dry them, for it often happens that these salts are spontaneously decomposed into sulphate, sulphate of ammonia and free sulphuric acid.

Sulphammonate of soda does not appear to be easily formed.

Sulphammonate of lead is prepared by double decomposition, in presence of a slight excess of ammonia.

The other sulphammonates are soluble in water.

SULPHAMMONIC ACID.

This acid may be isolated by treating the sulphammonates of baryta or lead by dilute sulphuric acid.

There is thus obtained an acid soluble in water, which possesses a strongly acid taste and reaction, and which, in its contact with bases, may reproduce the sulphammonates.

Sulphammonic acid is rapidly converted, in cold water, into sulphuric acid and bisulphate of ammonia.

NEW SALTS WHICH RESULT FROM THE ACTION OF COLD WATER ON THE SULPHAMMONATES.

I have stated above that when sulphammonates are boiled in water, they are decomposed into sulphates and ammonia. Before arriving at this last term of decomposition, we pass by an intermediate state which constitutes a series of new salts, of which it remains for me to make known the properties and composition.

When sulphammonates are abandoned for some hours in cold water, the liquor becomes powerfully acid, contains a bisulphate in solution, and deposits a new salt which

presents the greatest analogy with the sulphammonate, and which belongs to a new class of salts to which I give the name of *sulphamidates*.

SULPHAMIDATE OF POTASSA.

To prepare this salt, sulphammonate of potassa is abandoned in cold water for some hours, or else it is treated by water at the temperature of 140° to 158°F., which dissolves it at once, but which almost immediately deposits fine crystalline plates of sulphamidate of potassa. The mother liquor is powerfully acid, and retains in solution bisulphate of potassa.

The formula of this salt is—

$$5SO^3\ (SO^2\ NH^2)\ 3KO,$$

the sulphammonate being represented by—

$$7SO^3\ (SO^2\ NH^2)\ 4KO + 3HO.$$

The analyses, whose details I here pass over, prove that these two salts differ only by one equivalent from bisulphate of potassa.

The sulphamidate of potassa is white, sparingly soluble in water which dissolves only $\frac{1}{60}$ at the ordinary temperature. It presents some characters in common with the sulphammonate.

It is decomposed like it, in boiling water, into acid sulphate of potassa and sulphate of ammonia.

As the sulphamidate of potassa does not contain water of crystallisation, it can be preserved indefinitely without alteration; when heated to redness, it is decomposed, disengaging sulphurous acid, ammonia and sulphur.

Sulphamidate of ammonia is prepared by abandoning sulphammonate of ammonia for some hours in cold water.

This salt is very soluble, crystallises difficultly, and may be considered as a new reagent for the salts of potassa, which it precipitates by forming a sparingly soluble sulphamidate of potassa. It is decomposed by boiling water into acid sulphate of ammonia.

The sulphamidates of baryta, strontia, lime, &c., are prepared by double decomposition, and are, in general, more stable than the sulphammonates.

Such are the new facts which I wished to have the honor of submitting to the Academy. I will sum up, in few words, the theoretical consequences which flow from my researches.

It is at once evident that the sulphurous and nitrous acids exert on the sulphites a perfectly pecial action, and which present no analogy with that of the other oxygenous combinations of nitrogen.

Indeed, nitric acid converts the sulphites into sulphates, and disengages red vapors of gas.

Deutoxide of nitrogen is absorbed integrally by the sulphites, and gives rise to the nitrosulphates; whilst nitrous and hyponitric acids, in acting on the sulphites, form a new series of acids which are composed of sulphur, oxygen, nitrogen, and hydrogen, and which, under the sole influence of water, is converted into sulphuric acid and ammonia. These bodies present an evident analogy with those which are produced in the combination of anhydrous sulphuric acid with ammonia, and which have been so carefully examined by H. Rose and Jacquelain.

The production of ammonia in the reaction of nitrous acid on the sulphites is, I think, an unexpected fact, which may, however, be *connected with* the foregoing observations.

Is it not known, indeed, that when nitric acid acts with energy on some metals or on certain organic matters, the formation of ammonia is observed?

I will also call to mind that MM. Pelouze and F. Boudet have proved that hyponitric acid, in solidifying certain oils, produces a body which presents all the characters of an amide.

These facts will not remain isolated; I propose to demonstrate, in an early communication, that the nitrous and hyponitric acids should not be considered as only agents of oxidation, but that the nitrogen contained in these acids may, in combining with the hydrogen, form, in some cases, ammoniacal salts, and in others, true amides.

The investigations whose principal results I now make known, belong therefore to a general work in which I shall examine the mode of action of nitrous and hyponitric acids.

REMARKS ON IODIC ACID.*

BY C. RAMMELSBERG.

On a former occasion (*Poggendorff's Annalen*, xlvi.,.p. 159) I examined crystallised iodic acid with reference to its amount of water, and on repeatedly precipitating by nitrate of silver and determining the precipitate, partly as iodate, partly as iodide of silver, I arrived at the conclusion that the examined specimens were anhydrous.

Millon stated lately† that iodic acid, after having been previously dried over sulphuric acid, on being exposed to a heat of 338° F.,

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* *Poggendorff's Annalen der Physik und Chemie*, July, 1844.

† *Annal. Chim. Phys.*, 3 *Sér t.* ix., p. 400.

yields from 5·17 to 5·87 per cent. of water, of which two-thirds escape at 266°F. According to that assertion there would be one atom of water in the acid, for it supposed 5·13 per cent.

In consequence of this assertion I thought it necessary to repeat my experiments. The acid was separated by sulphuric acid from iodate of baryta, and after some concentration, on evaporation placed under a bell-glass, crystallised over sulphuric acid. By this process the iodic acid was deposited as little brilliant leaflets, in the same way as I constantly used to observe them; from another portion of the solution, however, which evaporated very slowly, I obtained a brilliant, transparent, evidently crystallised body entirely free from sulphuric acid, of which, however, a considerable quantity was always contained in the mother liquor.

A. The acid obtained in the form of leaflets was pressed between paper, and then dried over sulphuric acid. It was not entirely free from the latter, because, on account of its solubility in water, it could not be washed. 1·859, at a temperature of 257° F., lost 0·02 water, and at 356° F. the loss was augmented only by 0·008. The acid dried in this manner was now dissolved and precipitated by nitrate of silver. The iodate of silver dried at 302° F. weighed 2·869, answering to 1·68955 iodic acid. That this is the real composition of the salt was proved by fusing it, when it yielded 83·09 per cent. of iodide of silver (calculated =83·08). On separation of the silver the sulphuric acid was precipitated from the filtered mass by chloride of barium; 0·286 sulphate of baryta =0·0983 sulphuric acid.

The loss of weight at 356° F. amounts to 1·5 per cent.; hence not nearly one atom of water. On adding the requisite quantity of water for the sulphuric acid, the acid dried in this manner contains—

Iodic acid	92·28
Sulphuric acid	5·37
Water	1·20
	98·85

Hence this iodic acid is anhydrous. And that, moreover, the sulphuric acid is by no means chemically combined with the iodic acid is evident, since its oxygen amounts only to $\frac{1}{7}$ of that of the latter.

B. The acid obtained in crystals was reduced to a state of powder, and likewise dried over sulphuric acid.

4·15 parts, on being heated in a water-bath for several hours, finally lost 0·218; at 288° F. the loss rose to 0·222, but increased no more: hence the acid in these crystals contains 5·35 per cent. of water, that is one atom, which was found likewise by Millon.

The crystals, though rather brilliant, are yet too small to be measured, and lose in the air much of their lustre. As far as it may be seen they are rhombic prisms, the obtuse lateral edges of which are very much flattened by a plane, so that they appear to be of a tabular form. At the apex two pointed planes with obliquely decurring edges are noticed; hence it must be believed that the crystals belong to the classes mono and dimetrica.

Millon examined, moreover, some iodates, the composition and properties of some of which I described on a former occasion.* He quotes an analysis of the silver salt, which is anhydrous. According to his observation, iodate of lime on being exposed to the air attracts moisture. I, on the contrary, found the salt to be unaltered in the air, which, on account of its sparing solubility, cannot be otherwise. According to Millon, it contains 6 atoms; and, according to my experiments, 5 atoms of water. In the iodate of baryta and the iodate of strontia 1 atom of water of crystallisation is contained; he obtained the iodate of soda with 16, 12, 10, 6, 4, and 2 atoms of water; but his experiments do not, perhaps, prove the *individuality* of all these hydrates; and the method itself by which he reduced the salt to a determined amount of water, seems to have caused these numerous hydrates. I prepared it frequently, but constantly obtained only the easily-discernible hydrates with 2 and 10 atoms of water.

Millon demonstrates the non-existence of basic salts of the alkalies; he finds in the salt of magnesia 4 atoms of water, &c. All these and many other remarks in Millon's treatise are not new; I have already communicated them (*loco citato*), though the French chemist does not mention it.

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ON THE NATURE OF THE ELECTRICITY OF THE ATMOSPHERE.†

BY M. PELTIER.

1ST. PONDERABLE matter alone has the power of coercing the cause of electric phenomena; the phenomenon by which this coercitation is produced, is that which is

* *Poggendorff's Annalen*, vol. xliv., p. 545.

† From *Bulletins de l'Academie Royale de Bruxelles*. May 9th and 10th, 1842.—t. 9. No. 5, p. 416; and *Electrical Magazine*, Oct., 1844.

improperly named *resinous electricity*, or, still more improperly, *negative electricity*.

2nd. As pure space, void of ponderable matter, does not coerce this cause in a special manner, it cannot react with equal force against a *resinous* action; this negation of *resinous* re-action is termed *vitreous electricity*, or, more improperly still, *positive electricity*.

3rd. The earth, as being a ponderable body, possesses a powerful *resinous* tendency; and as the celestial space, by which it is surrounded, does not posses this condition, it is in the *less resinous*, or *vitreous* state.

4th. The earth, like every other electric body, in the midst of a free space, possesses its tenison on the surface; and this tension may increase or diminish in certain points of its surface, according as the bodies situated above it have a less or a greater tension; that is to say, according as these bodies are *vitreous* or *resinous* with respect to the electric mean of the globe.

5th. Every body situated on the face of the earth shares in its *resinous* tension. The more it projects into space, the more does this tension increase; thus mountains, edifices, and even organised beings have greater degrees of *resinous* tension than the soil on which they rest.

6th. When a body is insulated, after its having been placed in connection with the soil, it is in equilibrio of re-action in all its parts, and according to the distance of each of them; the lower portions are less *resinous*, the upper are more *resinous*. In this condition of distributive equilibrium, if this body possesses mobile parts, as the gold leaves of an electrometer, they will not indicate any preponderating action.

7th. If, under a dry and serene sky, this body or electrometer is moved further from the surface of the ground, or from an elevated body connected with the ground, as the re-action of the globe no longer operates in the same proportions on the length of the insulated stem, the *resinous* electricity becomes differently distributed; it increases towards the upper part, it diminishes towards the lower, and the mobile leaves attached to the latter separate from each other, in order to approach bodies either connected with the ground or possessing the same tension with it. This *less-resinous* tension, which the gold leaves now possess, is termed *vitreous*.

8th. If the electrometer is brought down again, the former equilibrium is restored, and the leaves rest at zero.

9th. If it is brought down below the point of equilibrium, as the reaction of the globe increases more on the upper than on the lower part, its *resinous* electricity is proportionately repelled; it becomes dominant in the lower portion, and the leaves diverge *resinously*.

10th. To deprive this experiment of all complication, the upper extremity of the electrometer must be terminated by a polished ball, so as to avoid radiation and to increase the effects of induction. In this condition the electrometer may remain for twelve hours, exposed to the air and winds, without its manifesting the least electricity.

11th. Since there is no electrical phenomenon without ponderable matter, radiation between two bodies differently electrised occurs more favorably as these bodies, or one of them, evaporate more easily; consequently, water, on the surface of the globe, which possesses a powerful *resinous* tension, evaporates under this electric influence. These vapors carry off a *resinous* tension, equal to that of the surface of the liquid, and they are diffused in the atmosphere, according to their specific gravity, and their repulsion as bodies charged with the same electricity.

12th. The vapors thus dispersed react from above downwards upon the electroscope; they place it within a *resinous* precinct, and the instrument, by rising or falling, experiences feeble differences of re-actions, or even sometimes it undergoes no appreciable reactions: in the latter case, it is only by an ascent with a kite or a balloon, that the extremity of the instrument can emerge from this precinct of homogeneous re-actions. By taking as a starting point the influence obtained under a serene sky, and with a continued cold of at least six degrees below zero (21°2 F.), the value of the diminution will be the measure of the quantity of *more-resinous* vapours, contained by the atmosphere.

13th. Fixed apparatus of limited extent are useless in dry and serene weather; they can give no manifestation of induced electricity, because they remain in their place of equilibrium; and they have not sufficient power to radiate the electricity contained in their parts, because dry air is a good insulator. When they have considerable length and are very elevated, as the extent of the wire compensates for their feeble local radiation, the apparatus loses its induced electricity, and becomes charged with permanent electricity.

14th. When the air is slightly moist, its radiation is favoured, and currents are obtained with shorter lengths.

15th. These electrical phenomena, arising as they do from atmospheric influences, must not be confounded with those produced by the oxidation of conducting wires, when

plunged into a moist medium. From this cause of error, it has frequently happened that effects, appertaining to chemical action, have been attributed to the atmosphere.

16th. When, through a fall of temperature, the first vapors are condensed, they form opaque clouds, and the electricity that they have carried away, is distributed according to their groupings and their ambient influences. The influence of the earth renders these clouds more *resinous* in the upper part than in the lower; consequently, the electrometer will exhibit a greater divergence under these vapors compacted into clouds, than when they were disseminated in all directions.

17th. When the temperature rises, and the primitive clouds pass again into the state of elastic vapor, it is under the *resinous* induction of the earth beneath, and under the *vitreous* induction above. The first vapors, which then rise, are more highly *resinous*, while the last are less so. The atmosphere then contains masses of *more-resinous* elastic vapors, and other masses of *less-resinous* or *vitreous* vapors. In a word, there are, under these circumstances, transparent clouds, some charged with *resinous*, others with *vitreous* electricity; and intermediate or neutral spaces, which are very clear. The limits of these transparent clouds may be discovered by means of the kite or balloon.

18th. The condensation of these transparent clouds forms secondary opaque clouds, charged with their respective electricities. A new rise of temperature produces a fresh division in the electric charges. The vapors first produced are more resinous than those which preceded them; the last are less so: they are *vitreous* in respect to the higher vapors and *resinous* in repect to the lower. It is in consequence of these successive condensations and evaporations that the upper vapors acquire *resinous* tensions of increasing value, while those near the ground become more *vitreous*. Intermediate there are some of different degrees, which are maintained separate by the difference of their specific gravity.

19th. In proportion as the vapors, in consequence of these transformations, become charged with an increasing electricity, their molecules acquire a greater degree of mutual repulsion; they are more repelled from the earth, or attracted toward space; they rise to much greater heights than those which correspond to their specific gravity. These opaque or transparent clouds, being charged to different degrees with *resinous* electricity some of which, in respect to the globe, which may be called normal, are *resinous*, and others *vitreous*—these clouds, we say, are in mutual equilibrio, when they approach in consequence of the condensations which arise from reductions in the temperature, and the reduced terrestrial repulsion, when other strata of clouds are interposed. Changes then occur which vary with their mode of agglomeration and their conductibility. These exchanges produce sudden explosions, if the periphery of the clouds contains much free electricity, or else *protracted explosions*, if the conduction is feeble, and if the discharge takes place along the masses opposed to each other.

20th. A discharge being a production of equilibrium in one point, excites other discharges; and thus it is that the meteors succeed each other, and may at certain periods become very numerous. Thus it is that simultaneous meteors, or those which succeed each other at short intervals, are observed in countries distant from each other.

21st. Consequent on these productions of equilibrium, or electric discharges, as the vapors become less repelled, gravity regains its influence; they fall, they condense, and finally they are resolved into rain.

22nd. Rains arising from *resinous* clouds are more abundant than those arising from *vitreous*; in like manner the winds are more sudden and more violent; and it is under the influence of masses of *resinous* clouds that tempests and inundations arise.—[A.]

AN ACCOUNT OF A NEW FORM OF GALVANIC BATTERY, WITH A NOTICE OF SOME GALVANIC EFFECTS OBTAINED WITH A SINGLE METAL AND A SINGLE EXCITING LIQUID.*

BY JAMES H. PRING, M.D.

I. A NEW FORM OF GALVANIC BATTERY.

The galvanic arrangement, which I have first to describe, is one in which sulphuric acid is employed as the exciting liquid; it consists of a cylindrical glass jar, eleven inches in height, and five inches in diameter, containing the battery immersed in the acid and water. This jar is mounted on a mahogany foot below, and above is furnished with a cover of the same material, varnished on its under surface, and fitted by a deep groove to the circumference of the glass. In the centre of the wooden cover is a circular aperture, two inches in diameter, to admit the introduction of a rod of amalgamated zinc, without removing the whole cover; and into the aperture is loosely fitted a plug of wood, having a small hole through the centre to allow the passage of the wire, by which

* *Electrical Magazine*, October, 1844.

the zinc rod is suspended. Immediately around the aperture for the introduction of the zinc are six smaller holes, into which are inserted the ends of a corresponding number of glass tubes, each tube being nine inches in length, and a quarter of an inch in diameter. The lower ends of these tubes are fixed by holes, similar to those in the cover, into a ring of wood, which is varnished. The object of the glass tubes thus arranged is to serve as a framework or support for a spiral coil of silver wire, which is wound around them from below upwards, the lower end of the wire being fastened to the varnished wooden ring, whilst the other end is carried through the wooden cover, on the upper surface of which it terminates in communication with a binding screw. The silver wire, which is platinised, is about 20 feet in length, and, from being flattened, forms a thin band about the sixteenth of an inch in breadth, the distance between each turn of the coil being about the eighth of an inch. In addition to the binding screw just alluded to on the upper surface of the wooden cover, there is also another, which is in communication with an arched wire or metallic support. The feet of this metallic arch are secured to the cover by screws; and the arch itself, on which the zinc rod is suspended, stretches across the aperture in the centre of the cover. The length of the zinc rod, that has been employed, is five inches, and its diameter one inch and three-quarters; there can be little doubt, however, that its length may be considerably reduced with advantage.

Into each of the small glass tubes that serve to support the silver wire, is introduced a bundle of fine iron wire, which, during the action of the battery, is rendered magnetic; the lower ends of the tubes are of course sealed, to prevent the action of the acid and water on the iron wire.

From this description, which has been rendered somewhat prolix, it might be inferred that the battery is of a complicated form; the reverse is actually the case.

From information kindly communicated to me by Mr. Crosse, of Broomfield, to whom electrical science stands so deeply indebted, it is in my power to state, more precisely, the relative value of the two forms of coil and cylinder, when used as the negative elements in a series of Daniell's batteries. In an experiment, in which twenty spirals of common bell-wire were wound around each separate porous pot, Mr. Crosse states that he found "that sixteen of these coils, each forming a cylinder of nine inches in height and three inches in diameter, somewhat exceeded in powers of decomposition and ignition, seventeen cylinders of sheet copper, each formed out of a plate nine inches square, and rolled up." The form of a spiral coil of wire for the negative element, has been extensively adopted by Mr. Crosse for the last three or four years; and an account of the efficiency of a battery, in which this form of negative element was used, is found in the third volume of The Chemist.

Whether the magnetism developed in the bundles of iron wire introduced into the glass tubes is to be regarded as an advantage or otherwise, I must leave to be determined by those who may enjoy fuller opportunities of investigating the subject than myself; it seems, however, not unreasonable to suppose that the action of the battery is in some way modified by this part of the arrangement, and it would be interesting to ascertain whether the modification is one of increase or of diminution of power. In the meantime, as a new feature in the construction of a battery, and as an additional fact, tending to illustrate the intimate connexion subsisting between the electric and magnetic forces, this part of the arrangement cannot be regarded as wholly devoid of value.

I have to acknowledge my obligations to Mr. Tylee, chemist, of this city, who has done me the favor of testing the action of this battery on his galvanic clock; and he assures me, after many months' trial, that, for the purpose of working the clock, he considers it in every respect preferable to the ordinary platinised battery. Before closing the present notice of this battery, it may be observed, that, whilst it combines in itself the advantages of economy, efficiency of power, convenience of application, and elegance of form, it seems still susceptible of some new applications and of additional improvements. Thus I have already applied it to the purpose of procuring the hydrogen for the Döbereiner light, for which it possesses the advantage of allowing amalgamated zinc to be substituted for the ordinary zinc in common use. In its application to this purpose the circuit is, of course, always maintained closed, the hydrogen being evolved from the platinised silver wire. It is manifest also, in the ordinary employment of the battery, that, by a suitable mechanical contrivance for collecting the hydrogen and again permitting its escape, this gas may be made to serve the purpose of regulating the power of the current, the acid and water being alternately depressed by the elastic force of the confined gas, and again allowed to ascend during its escape, in place of the alternate ascent and descent of the battery itself, as under the employment of Mr. Bain's voltaic governor.

II. GALVANIC EXPERIMENTS WITH A SINGLE METAL AND A SINGLE EXCITING LIQUID.

It may perhaps be permitted me, in concluding the present communication, briefly to notice certain galvanic effects obtained with a single metal and a single exciting liquid; the following being a description of these effects, and of the arrangement employed in producing them.

A porous pot of the common unglazed biscuit ware, six inches in height and three inches in diameter, filled with dilute sulphuric acid, and having on its exterior a spiral coil of copper bell wire, and a similar coil of the same metal in contact with its interior, was well insulated on an appropriate varnished wooden foot, and the ends of the wires connected with the galvanometer, when, on the occurrence of a free filtration of the fluid through the pot, the needle of my galvanometer (which, though delicate, is not astatic) was deflected from 70° to 80°.

It is worthy of remark, however, that, with this considerable deflection of the needle, the current appears incompetent to effect chemical decomposition, neither is any perceptible effect communicated by it to the tongue, nor to the limbs of a recently-killed frog; nor are these effects obtained, so far as I have been enabled to observe on a limited scale, by multiplying the number of the pots, and connecting their wires together in the manner adopted in a battery composed of dissimilar metals.

In another experiment in which liquor potassæ diluted with water was substituted for the dilute sulphuric acid, the needle of the galvanometer was less powerfully affected; but the copper wires in this, as well as in the former instance, were slowly dissolved by the solution. It may be mentioned further, that with a small porous pot, scarcely four inches in height, and only one inch and a quarter in diameter, filled with a solution of cyanide of potassium, and furnished on its exterior with a coil of wire about six feet in length and the thirtieth of an inch in diameter, of pure gold, reduced from the chloride, and with a similar coil of the same wire in its interior, the needle of the galvanometer was deflected from 75° to 80°, on the occurrence of a free filtration of the solution through the pot.

These experiments, made many months since, are selected from amongst several others of a similar description, merely for the purpose of inviting attention to an interesting and extensive field of inquiry, for the fuller investigation of which, the arrangement just described appears to offer peculiar facilities.

Bath, September 4th, 1844.

POLYKRAS AND MALAKON, TWO NEW SPECIES OF MINERALS.*

BY TH. SCHEERER, OF CHRISTIANA.

The remarkable granitegangues of Hitteröe contain besides gadolinite,† orthite,‡ and ytterspath,§ among their accessorily admixed parts two other minerals, which have been hitherto unknown. They both in conjunction with the ytterspath usually accompany the orthite, in which they are more or less distinctly interspersed; and to this circumstance it is probably to be attributed the fact that on analysing the orthite of Hitteröe sometimes small quantities of titanic acid and zirconia‖ are found, which certainly do not belong to this mineral, but may originate partly from the admixed polykras, partly (the zirconia) from the malakon.

The following mineralogical characteristic of both the minerals, is an extract of an essay,¶ published by myself in the the 2nd number of *Keilhau's Gäa Norvegica*, and the description of the method adopted in the analytical investigation is taken from a treatise delivered by me this year before the Association of Naturalists at Christiana.

1. POLYKRAS.

The name of this mineral (derived from πολὺ and κρασις) is justified by what will be stated in the sequel, concerning the composition of polykras. The polykras being nearly related to the polymignite, a circumstance to which I have intended to allude to by this name, I will in the following passages point out the essential differences noticed between the two minerals.

Exterior Aspect.—Only crystallised. The crystals are frequently many times as long as broad, and many times as broad as

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* *Poggendorff's Annalen der Physik und Chemie*, July, 1844.

† *Poggendorff's Annalen*, vol. li., pp. 407 and 465; vol. lvi., p. 479.

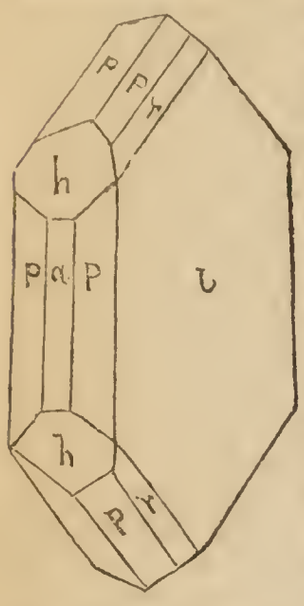
‡ *Ibid.*, vol. lvi., p. 479; vol. lxi., p. 636.

§ *Ibid.*, vol. lx., p. 591.

‖ *Ibid.*, vol. lxi., p. 644.

¶ "On the norite and the granitegangues rich with minerals of this rock species, as occurring in the Isle of Hitteröe." In this treatise I, at the same time, directed attention to some circumstances which are in perfect contradiction with pure volcanic views. Though some of these circumstances are perfectly in accordance with the presence of malakon and polykras, I did not notice them in the treatise before me, but only refer to the article quoted above. The 2nd number of the *Gäa* is printed, and will soon be ready for sale.

thick; their absolute length sometimes amounts to 1—1½ inch, and is seldom less than one-third of an inch. The system of crystallisation to which they belong is the rhomboidal (of 1— and 1 axis). Fig. 1 shews the form in which they are met with. The planes *a* and *h* are but seldom met with, and *r* more seldom still: most of the crystals are only limited by *p p* and *b*. On measuring by the goniometer (the reflective goniometer could not be used on account of the lustreless surfaces of the crystals), the following inclinations of the planes were noticed:—a : b = 90°; p : p = 140°; P : b = 104°; P : P = 152°; r : b = 127°. Hence the form is a combination of—



P· ∞ P· ∞ P· ∞· ∞P ∞·2P ∞·P ⅓,*

and the length of the main axis to that of the brachydiagonal and makrodiagonal secondary axis, is approximatively as a : b : c = 0·940:1:2·747, whereas the polymignite is in the ratio of a′ : b : c′ = 0·676:1:1·402.† On comparing the mutual relation of the axes of the two minerals, the results deviate from those obtained on measuring the angles, to such an extent as not to admit of being attributed to an error of observation. If we were to assume a = ⅔a′, hence a = 1·014 instead of = 0·940, it would hence for instance follow that the equal angle, formed by the two obtuse vertical edges of the main pyramid be = 89° 12′. On direct measurement, however, of several crystals, which operation with this angle is remarkably easy, and may be executed with great precision; it was found to be 94°, and on a calculation based on the measurement of the other angles, it was found to be 93° 33′. The mutual relations of the axes of the polykras cannot therefore be derived from those of the polymignite.

Internal Structure.—Of a lamellar stratification traces can in no direction be discovered. The fracture of the mineral is perfectly conchoidal. The polymignite possesses some obscure lamellar strato, parallel with its planes ∞ P ∞ and ∞ P ∞.

Hardness.—The crystals being mostly thin and very brittle, this property could but with difficulty and imperfectly be determined. I thought, however, that the polykras was less hard than the polymignite. The hardness of the latter being between quartz and feldspath, the former is somewhat less hard than the feldspath, and harder than the quartz.

Specific Gravity.—On being weighed twice, it was the first time found to be 5·12, and the second time 5·09. The first time 3·293 grammes were employed, and the second time a somewhat smaller quantity of pure crystalline fragments. As a mean term, therefore, the specific gravity of the polykras may be considered to be 5·105. The specific gravity of the polymignite being = 4·80.

Behavior with Reference to Light.—On directing the rays of light upon polykras, it appears to be of a pure black color. By means of a lens it may be noticed that very fine splinters of this mineral are transparent, presenting a yellowish-brown color; the same happens if the mineral is reduced to powder, and its grains are examined by the microscope; they depolarize the polarized light. On directing rays of light upon polykras reduced to powder, it appears of a gray-brown color. The lustre of polykras is somewhat less vivid than that of the polymignite but, however, of the same nature.

Heat.—If a crystal of this mineral is at once exposed to heat higher than 212°F., little fragments are separated, and with an audible noise thrown briskly to some distance. We may account for this decrepitation by the escape of water or some other volatile substance; for on the termination of this phenomenon the mineral is lighter by from 1 to 1·25 per cent., without having undergone any change with regard to its other properties. But if a piece of the polykras is ignited as quick as possible, then, when scarcely yet dull red, it becomes manifestly pyrognomic, almost to the same remarkable degree as gadolinite itself. The properties of the calcined mineral differ in several essential points from those of the mineral which has not been ignited. The change of color is most striking; it was

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* These P P̆ forms of letter should be here employed, and also whenever the ordinary P is inserted under the same circumstances. The letters could not be obtained from the foundry in time for press.

† The polymignite crystallises in rhomboidal prisms of 109°, acuminated by a rhomboidal pyramid, with vertical edges of 136° 28′ and 116° 22′. (*Vide Glocker's Mineralogie*, p. 371). Hence follows:—

b : c = 1 : $\mathrm{tg}\frac{1}{2}$. 109° = 1 : 1·402; and

a : b = tga : 1, when sin. $a = \frac{\mathrm{tg}\frac{1}{2}\cdot 109^\circ}{\mathrm{tg}\frac{1}{2}\cdot 136^\circ\ 28'} =$ 34° 3′. Consequently a : b = 0·676 : 1.

of a dark-black, it now becomes light gray-brown, *perfectly like the color which the non-ignited mineral exhibited when in a state of powder*. Reduced to powder polykras is of a grayish ochre-yellow color, and the the smallest grains of this powder, viewed under the microscope appear to be perfectly *opaque*. The lustre of the calcined mineral likewise differs from that of the non-ignited one; it become somewhat more feeble and less metallic, but more greasy. After these alterations a considerable change with regard to specific gravity might reasonably have been expected; which, however, strange enough did *not* take place, 3·251 grammes of the calcined fragments of the crystals were employed to ascertain the specific gravity, by which resulted a specific gravity of 5·103, hence exactly equal to that which the mineral exhibited previous to its being calcined. These crystalline fragments, however, on being reduced to powder, showed by all means a higher specific gravity, namely =5·20. Yet a similar inconsiderable increase of specific gravity might probably have been obtained with the non-calcined crystals on reducing them to powder previous to their being weighed. Polykras is infusible at a strong red heat.

Behavior before the blowpipe. — Dissolved in borax, on being exposed to the oxidising flame, the mineral offers a yellow color; with the reduction flame it exhibits a yellow-brown, or brown color; the latter especially if the reduction is operated with tin on charcoal. The bead obtained with the salt of phosphorus in the oxidising flame is yellow or yellow-brown, becoming, on cooling, of a greenish or dirty green color; treated with the reduction flame it assumes a dark color, which cannot be particularly described—it is perfectly similar to that of the euxenite when treated in a similar manner (*vide Poggendorff's Annalen*, vol. l., p. 150). Heated on platinum leaf with soda or nitre, the mineral yields no trace of amanganic reaction; on being treated with soda or charcoal no metallic grain can be obtained.

Behavoir with acids.—The polykras on being reduced to a fine powder, and heated with hydrochloric acid, is but imperfectly resolved, but on being for a longer time heated with sulphuric acid, it is completely resolved. The calcined mineral which exhibited the phenomena of ignition, on being reduced to powder, is likewise resolved by this acid.

Chemical constitution. — The method adopted in the qualitative analysis of the polykras was as follows:—The finely powdered mineral was resolved by being treated with hot sulphuric acid, and then, on the addition of some fuming nitric acid, heated again until vapors of sulphuric acid began to rise. The mass was then covered with water and put in a warm place, when all was dissolved except a small quantity of a white residue (*a*). The filtered liquid on being much diluted with water, and boiled, deposited again a much larger quantity of a white powder (*b*), and on this being filtered off, the solution was precipitated by caustic ammonia. In the liquid removed from the precipitate there were contained traces of lime, magnesia, and, perhaps, of an alkali. The precipitate thrown down by caustic ammonia was dissolved in muriatic acid, and the solution, on being diluted by a little water thrown by drops into a concentrated solution of carbonate of ammonia, and what thereby remained insoluble was dissolved in hydrochloric acid, and boiled with caustic potassa, by which means some alumina was extracted. What was not dissolved by caustic potassa was again treated by carbonate of ammonia, when again a white flaky mass (*c*) remained undissolved; the filtered liquid was now united with that obtained on the first treatment with carbonate of ammonia, and hydrosulphate of ammonia added, the liquid was allowed to stand for twenty-four hours, when the black precipitate (*d*) was entirely deposited. The supernatant solution was of a yellow color. On being filtered off from the black precipitate, the liquid was supersaturated by hydrochloric acid, and committed to a warm place until the separated sulphur (*e*) was entirely deposited on the bottom of the glass. The liquid filtered off from the sulphur was treated by ammonia, when a yellow precipitate (*f*) was thrown down.

The substances *a*, *b*, *c*, *d*, *e*, and *f* were then, partly in the humid way, partly by the blowpipe, subjected to more exact investigations, when the following results were obtained:—*a* was pure tantalic acid; *b* titanic acid, mixed with tantalic acid; *c* consisted of a mixture of yttria, zirconia, oxide of iron, protoxide of cerium, tantalic acid, and alumina; *d* consisted chiefly of sulphuret of iron, containing, moreover, yttria, and, perhaps, traces of cerium and uranium; *e* was not pure sulphur, but, on calcining, left some titanic acid; *f*, finally, was mostly composed of zirconia, yttria, and oxide of uranium,* with a small quantity of

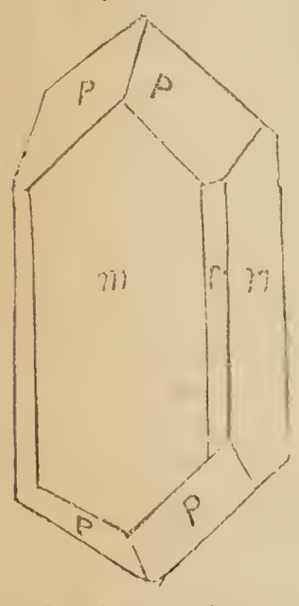
* That the greatest quantity of the uranium was contained in precipitate *f*, and not, as it might have been presumed, in precipitate *d*, in conjunction with the sulphuret of iron, must be attributed to the fact, that sulphuret of uranium, at least, under certain

protoxide of cerium. Hence the following names comprise the whole of the constituent parts of the polykras :—Titanic acid, tantalic acid, zirconia, yttria, oxide of iron, oxide of uranium, protoxide of cerium, with a small quantity of alumina, and traces of lime, magnesia, and, perhaps, an alkali. According to Berzelius, the constituent parts of the polymignite are titanic acid (46·30), zirconia (14·14), oxide of iron (12·20), lime (4·20), protoxide of manganese (2.70), protoxide of cerium (5·00), yttria (11·50). The material differences between the constitutions of the two minerals consist, therefore. 1. In the presence of tantalic acid, and the oxide of uranium in polykras. 2. In the absence of protoxide of manganese, and in the almost entire want of lime in this mineral. I did not try to analyse the polykras quantitatively, since, on separating similar rare substances occurring in such a manner as they are grouped in this mineral, analytical chemistry, in its present state, almost entirely forsakes us.

II. MALAKON.

I named this mineral malakon (from *μαλακός*), because it is distinguished from zircon, to which, in several respects, it is nearly related; among other characteristics by its hardness.

Fig. 2



Exterior aspects.—Malakon occurs only under the crystalline form; it is found either in isolated crystals, or in crystalline groups. The system to which it belongs is the quadratic (1—2 axes), and the only combination in which I found it, is ∞P·P·∞P∞, as fig. 2 shows. On measurement, by the reflective goniometer, I found the inclination to be p : m = 135°, P : p = nearly 131° (the zircon is = 132° 10′), and P : P = 121° 57′ (the zircon is = 123° 19′). Hence in the malakon the length of the main axis is, to that of the secondary axis a : b : b : = 0·611:1:1, whereas, according to the measurement of Mohs, the zircon is 0·610:1:1. The square prism ∞P∞ is, in all the crystals of the malakon in my possession, sometimes even ∞P disappearing, particularly developed; in none of these crystals, however, the main prism alone occurs—nay, it is even not predominant. In the zircon, as is known, the case is just the reverse. Hence, though only superficially considering the form of crystallisation of the malakon, it would appear to be identical with that of the zircon; yet, on a more accurate examination, differences are found out which cannot be considered as immaterial.

Internal structure.—The zircon is parallel to the planes of the main prisms imperfectly cleavable; the malakon shows in no direction a predominant cleavage, but is almost everywhere a more or less perfect conchoidal fracture.

Hardness.—About that of the feldspath, entirely fresh crystals seem to be somewhat harder; they are all, however, to be scratched by quartz, and more evidently still by zircon.

Specific gravity.—On having weighed three times I found 3·934—3·910—3·895. On weighing the first time 1·322 grammes of crystals were employed; which, moreover, offered a dark color, and were probably mixed with polykras. I, therefore, picking out the most pure crystals, weighed twice again, employing each time about three grammes; the results obtained in this way were considerably less than that obtained the first time. It seems, therefore, that 3·934 was erroneous, and that the specific gravity of the malakon is a mean of 3·910 and 3·895=3·903. If it is, however, intended to admit the first weight as the true one, the mean specific gravity will be =3·913. The specific gravity of the zircon is 4·4—4·6.

Behavior with reference to light.—The rays of light on being directed upon entirely pure fragments of this mineral, it appears to be of a bluish-white (nearly milky white), with a slight admixture of the gray. The surface of the crystals, however, seldom offers so light a color, but being mostly covered by a coating of foreign substances, it is partly of a brownish, reddish, yellowish, or blackish color. In splinters and smaller parcels, malakon is transparent, and of a yellowish-white. Its powder, on being viewed under the microscope, is perfectly colorless and transparent. The surfaces of the crystals of the malakon are of a glassy lustre, though of a less degree than those of the zircon; on the fractures, however, the lustre is resinous or greasy. The whole of the exterior of a fragment of this mineral reminds one of the milk-white common opal, or the enamel obtained on fusing together a glass containing oxide of lead with some oxide of tin.

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circumstances, in no inconsiderable quantities, is soluble in hydrosulphate of ammonia. Of this assertion I likewise obtained proofs by direct experiments.

Behavior with reference to heat.—If a piece of malakon is calcined, the heat being raised as quickly as possible, phenomena of light are exhibited, which, though very feeble, yet, under certain precautions, to the experienced eye are clearly perceptible. These phenomena are better noticed in proportion as the bulk of the pieces is larger; if the pieces are only of one cubic line, they are scarcely to be perceived. Though malakon, if compared with gadolinite and polykras is possessed of the property of pyrognomy to a very small extent, yet the changes which this mineral, after the appearance of this phenomenon undergoes, are important. Between the calcined and uncalcined crystals of this mineral we discover, with the eye, no other difference than that the first becomes of a yellowish color, which was not the case previous to the calcination, and by which they are more or less similar to zircon. This change of color, however, not being alike with the whole of its crystals, we may perhaps ascribe it to some incidental circumstances. More material, however, than this change, is the fact that the specific gravity of the calcined malakon is considerably higher than that of the non-calcined one. In two experiments, the one with 1·321 grammes and the other with 1·828 grammes of the mineral, I obtained in the first case a specific gravity of 4·228, and in the second 4·212, hence as a mean =4·220, whereas the specific gravity of the uncalcined mineral was found to be from 3·903 to 3.913.

The volume, therefore, of the uncalcined mineral to that of the calcined one is as 100:92·49, or 92·63.* It is, moreover, to be kept in mind that by calcination the mineral changes, likewise its absolute weight, its loss of water, amounting to 3·027 per cent.; 1·8995 grammes of the fresh crystals of malakon dried at 176°F. on calcination amounted only to 1·8420 grammes.

To the loss of this not inconsiderable quantity of water, and to the circumstance that with the malakon, the phenomena of ignition do not take place before a rather strong red heat is produced, it may, perhaps, be attributed that this mineral is not pyrognomic to a great extent.

On treating of the behavior of the malakon with reference to acids, I will direct the attention to another very material change which the malakon undergoes on being calcined. At a light red heat the malakon, even in the thinnest points of one of its splinters, does not melt.

Behavior before the Blowpipe.—Small pieces of the mineral are not dissolved, either in borax or in microcosmic salt, but become, however, of a white color, and lose their transparency. Reduced to a state of very fine powder, it is in small quantities dissolved by both the microcosmic salt and the borax, with the first separating a skeleton of silica. Of coloring matter only a trace of oxide of iron is to be noticed.

Behavior with reference to acids.—The finely powdered mineral is not resolved by hydrochloric acid; by hot sulphuric acid, however, if previously washed, on continued digestion, it is decomposed. Fluoric acid most quickly and completely resolves the malakon. *If it be, however, previously calcined it resists all these acids;* and then it can only be completely decomposed by fusing with carbonate of soda. The calcined malakon, therefore, behaves with acids like zircon.

Chemical constitution.—To ascertain the composition of the malakon, after having found, by some preliminary experiments, that silica and zircon are of its principal ingredients, I fused a certain quantity of the finely powdered mineral with some carbonate of soda, throwing on the fused mass some water, when a white crystalline powder was separated, completely resembling zirconuret of soda.* On this heavy powder was floating a slight quantity of a flaky substance, and on that which was supernatant a perfectly colorless limpid liquid. The heavy powder (*a*) was separated from the flaky substence (*b*) by washing, and the flaky substance from the supernatant liquid (*c*) by filtration. The investigation was repeated three times, and the results were the following:—*a* was zirconuret of sodium with a small quantity of silica (scarcely one per cent.); *b* consisted of oxide of iron, zirconia, yttria, lime, magnesia, silica, a small quantity of each; *c* finally contained the greatest quantity of the silica in solution. The quantitative proportions in which these substances were found, were—

Silica	31·31
Zirconia	63·40
Oxide of iron	0·41
Yttria	0·34
Lime	0·39
Magnesia	0·11
Water	3·03
	98·99

* With the gadolinite of Hitterö, I found the proportion to be as 100:93·95, with the orthite of Filefjeld, as 100:92·64, and with the allanite of Jotunfjeled, as 100:94·47. (*Vide Poggendorff's Annal.* vol. li, p. 494.)

* *Poggendorff's Annalen*, lix., p. 481.

The separated silica, both before the blow-pipe and with the fluoric acid, behaved perfectly normally. The zirconia possessed the following properties:—On calcination it was perfectly insoluble in acids, and, freshly precipitated, it was likewise insoluble in potassa and in ammonia. Its hydrochlorate offered the characteristic radiated crystalline appearance falling into powder in the air; from the hydrochlorate of zirconia, on being dissolved in water, and a piece of sulphate of potassa put into it, a very considerable precipitate was thrown down, by which the liquid finally became of a pulpy consistence. The liquid of this precipitate, however, washed with water, contained still zirconia in solution, which was precipitated by ammonia, transformed then into a hydrochlorate, and again treated by a sulphate of potassa. This process, having been repeated three times, the precipitate, on being removed from the liquid, retained in solution only traces of zirconia. The solution of the earthy hydrochlorate being thrown by drops into a concentrated solution of carbonate of ammonia, no precipitate was thrown down.

That of the just stated constituent parts, silica, zirconia, and, perhaps, water are the only essential ones, and the remainder, merely accidentally admixed, may be taken for granted. The malakon being of frequent occurrence associated with the polykras, and sometimes with the ytterspath, it may happen that even picked specimens of it be not perfectly free from admixtures of these two minerals. The circumstance that, besides the stated constituent parts, traces of titanic acid, protoxide of cerium, and phosphoric acid are found, seem to confirm this supposition. If, however, these three constituent parts are the only chemical ones, the chemical formula to be derived will be as follows:—

$$\dot{\dot{Z}}r_2\,\dot{\dot{S}}i + H.$$

According to which the composition of the mineral would be—

Silica	32·43
Zirconia	64·06
Water	3·51
	100·00

Hence the malakon would be a hydrated zirconuret, which, on calcination losing its water under pyrognomic phenomena, is transformed into the common zircon. Its specific gravity on calcination =4·22 would perhaps be higher and more approximate to that of the zircon, if the calcined crystals, which are undoubtedly permeated by several fissures,* were, previous to being weighed, reduced to a state of powder. Not being, however, in possession of a considerable number of these crystals, I could not till now undertake this experiment. The very considerable increase of specific gravity, and its behavior with reference to fluoric acid changed on calcination, are by all means sufficient to warrant the opinion, *that the zirconia met with in the malakon is in a different isomeric condition from that of the zircon; but that on calcination, under phenomena of light, it passes over into the same modification as it is contained in the zircon.* Perhaps even the different isomeric condition of the zirconia is the only essential difference between zirconia and malakon, and the 3·03 per cent. of water, are to be considered as non-essential. In that case the chemical formula of the

$$\text{Malakon} = \dot{\dot{Z}}r_a\,\dot{\dot{S}}i \qquad \text{Zircon} = \dot{\dot{Z}}r_b\,\dot{\dot{S}}i.$$

I consider this view to be more probable than that pronounced before, because, on the one hand, as far as I am aware of, a real hydrate, containing so little water as malakon does, has never been observed; and, on the other hand, cases of minerals not unfrequently occur containing variable quantities of water, with which they part only on calcination.

With regard to the latter circumstance, I need only to direct the attention to some gadolinites, orthites, and elaeolithes, which, notwithstanding sometimes presenting no inconsiderable quantities of water, are yet by nobody considered as hydrates.

—nt—

PREPARATION OF SULPHOCYANIDE OF POTASSIUM.†

BY DR. LIEBIG.

In my last treatise on mellon (see THE CHEMIST, No. lviii.,) I pointed out the method of preparing the sulphocyanide of potassium, which, as regards the proportions of the weight of the substances to be employed was not correct. In-

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* That on the calcination of the malakon very narrow fissures are formed, appears from the fact that, when for the exact determination of the specific gravity, the crystals, being previously calcined, are heated in boiling water, on being dried in a warm place, pertinaciously retain one per cent. of water, which cannot be expelled but by repeated calcination.

† *Liebig's Annalen der Chemie und Pharmacie*, August, 1844.

stead of 46 parts of ferrocyanide of potassium, 17 parts of carbonate of potassa, and 16 parts of sulphur, it ought to be 46 parts of roasted ferrocyanide of potassium, 17 parts of carbonate of potassa, and *thirty-two* parts of sulphur.

The proportion is calculated that one atom of ferrocyanide of potassium be employed for 8 atoms of sulphur; of these 8 atoms of sulphur, 6 unite with the cyanogen to form sulphocyanogen, and 2 atoms combine with the iron, forming sulphuret of iron ($Fe\ S^2$). The potassa is sufficient to substitute the iron.

The quantity of potassa is too small by $\frac{1}{4}$ equivalent, but it is better to lose a small quantity of the sulphocyanide of potassium, than to run the risk of rendering the substance impure by an admixture of sulphuret of potassium. —nt—

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

EXPLOSION OF COAL MINES.

To the Editors of The Chemist.

GENTLEMEN—

As the frequent occurrence of colliery explosions is no longer capable of being explained away by the supposed negligence of the workmen, allow me, through the medium of your periodical, to make a few observations which may probably open a new field of inquiry as to the real cause of these disasters. From the unvarying evidence given in such cases, it appears that the most experienced eye is unable to detect any symptoms of the approaching evil, and that no indication of danger presents itself up to the moment at which the accident happens—a convincing proof that the explosion proceeds from some sudden outburst of gaseous matter, against which ventilation and the Davy lamp are equally ineffectual; not that I wish to undervalue these means upon which so much of the present system of working coal depends, but merely to infer from their acknowledged want of safety that these dreadful and unexpected explosions do not arise from any circumstance which it is in the power of ventilation or the Davy lamp to prevent, but proceed from the sudden liberation of some more inflammable gas than that which the ordinary wire-gauze of a safety lamp is intended to counteract.

Sir H. Davy justly observes that the mesh of the wire-gauze ought to be adapted to the nature of the gas, for the more inflammable this is, the smaller should be the openings in the gauze, as a mesh which totally extinguishes fire-damp will yet allow an explosion to take place with olefiant gas, and one which is proof to this latter gas, is not at all so to hydrogen; if, then, a more inflammable gas than fire-damp or subcarburetted hydrogen is ever generated in coal mines, the Davy lamp will no longer insure safety; but can such gas be formed under the common operations of Nature from coal? Judging from analogous cases, I should say unquestionably it may.

To prove the truth of this supposition it becomes necessary for me to explain what is called by the miners a "blower," and also to allude to a practical fact in the manufacture of coal gas. The pitmen on removing portions of coal from the mass necessarily expose fresh surfaces of the mineral; these are more or less intersected by fissures or cracks which communicate with each other, and also run far back into the substance of the coal, and terminate in large or small cavities filled with gas, which having been slowly given off by the coal exists in a high state of compression in consequence of the unyielding nature of the enclosing walls; the removal, however, of that portion of coal which blocked up the ends of the cracks allowing a free exit for the confined gas, it rushes violently along the fissures mentioned above, and escapes with a loud hissing or blowing sound, to which the term blower has been very correctly applied, and thus large collections of gas slowly and harmlessly make their way into the air passages of the pit, and are carried off by the upcast shaft. From this description it is obvious that a very large portion of the gas, from a recently opened blower, must have been formed and retained for ages under a very high pressure; now, would the nature of the gas not be greatly modified by these circumstances? We turn to facts. It is well-known in the manufacture of coal gas, that the greater the pressure in the hydraulic main, the less will be the illuminating power of the gas, or in other words the larger the relative proportion of hydrogen, compression during the evolution of the gas apparently inducing the hydrogen to pass off uncombined with the carbon, and consequently a more inflammable but less illuminating product is obtained. I speak here of the effect of pressure from a

few inches of water; but we have seen that in the case of a blower, cavities are filled with gas at an enormous pressure; it becomes useless then to pursue the argument further. Again, although in a general way these cavities empty themselves harmlessly through the fissures, yet it may happen that there is no exit from one of these cavities, or that the exit does not happen to run in the direction of the working; in this case, as the coal is removed, the pressure will at length overcome the gradually diminishing resistance in the line of the working, and the gas escape suddenly into the air passages of the pit. Let us suppose such a cavity, say two feet cube, filled with gas at a pressure of six atmospheres, this gas consisting chiefly of hydrogen; the miner unconsciously effects an opening, and several hundred cubic feet of inflammable matter rush at once upon him, and mixing with the air in the air passages, forms in a moment an explosive mixture, capable of being ignited by his own lamp; for however rapid the current of air in the air passages might be, it could never safely carry off such a torrent; explosion would be inevitable.

It may be said that this theory does not account for the after-damp nor will it, on the supposition that the after-damp; consists of carbonic; acid but from the rapidity with which the pit becomes freed from after-damp, it is highly probable that nitrogen is its principal constituent; added to this there is an opinion amongst the miners that after an explosion it is safest to breath the air nearest to the ground, although the reverse would be the case if the after-damp were composed of carbonic acid, whereas nitrogen being lighter than common air, would justify the adoption of such a practice.

There is yet another source from which an explosion may proceed, this consists in the very probable contact of the steel-pointed pickaxe of the miner, with a portion of the iron pyrites abounding in these localities, the scintillations from which are infinitely more to be dreaded than those from flint and steel, as in the old steel mill. My knowledge of this matter, and of government commissions generally, does not lead me to hope for much benefit from such a source; but the coal owners themselves might and ought to have the matter carefully examined: great satisfaction would certainly result, although the public learned no more than that the means now employed to insure safety were quite incapable of improvement.

I am, Gentlemen,
Your obedient servant,
A Minor Miner.

ANALYSIS OF DUNG MANURE.*

BY M. HENRY BRACONNOT.

M. de Dombasle, under the conviction prevalent among agriculturists, that dung serves as food for plants, has several times expressed his desire to ascertain with accuracy its constituent parts, and so to discover how to account for the influence of manure in accelerating and feeding vegetation. Shortly before his death he proposed to me to analyse the dung, which, in consequence of advanced fermentation, was reduced to the state of a pasty blackish-brown mass, called by agriculturists *black-butter* (beurre noir), to which they attribute a high fertilising power for light soils. To satisfy the wish of this able agriculturist, I subjected this *black-butter* to the following experiments:—The manure coming from a farm was diluted in a glass mortar with a sufficient quantity of pure water, then filtered, to separate the portions soluble in water from those which are insoluble therein; a deep brown liquid passed through, which I designated by the name of *juice of dung*. It contains a variable quantity of carbonate of ammonia, which may be obtained by distillation. Acids throw down from the juice of dung an abundant brown precipitate, the separated liquid remaining nearly entirely colorless.

To the juice of manure I added nitric acid in excess, and, after having filtered off the almost colorless liquid from the colored precipitate, I examined it by reagents. Oxalate of ammonia and chloride of barium rendered it scarcely turbid, but nitrate of silver formed a precipitate of chloride of silver. An excess of lime water produced a light flaky precipitate, which I found to be phosphate of lime. Another portion of the same almost colorless liquid, on being evaporated, furnished crystals of nitrate of potassa mixed with nitrate of ammonia. The juice of manure, precipitated by tartaric acid and filtered, produced during the process of evaporation a considerable quantity of bitartrate of potassa mixed with bitartrate of ammonia.

To isolate the substances contained in the juice of manure, I evaporated it to the consistence of honey; I treated it with alcohol of 32° Baumé, by which it became merely of a light yellowish color, an abundant black matter being left, which this liquid could not dissolve. This latter substance will soon be examined. The alcoholic liquid, on being reduced by heat to the consistence of a syrup, yielded, by spontaneous evaporation, crystals of chloride of potassium, and a brownish

* *Annales de Chimie et de Physique*, October, 1844.

mother liquor, which frothed very much like soap-water when blown into it by a tube. This rather strongly alkaline mother liquor contained indeed a true soap, with an excess of potassa and ammonia, these being partly carbonates. Dilute sulphuric acid produced a vivid effervescence, throwing down a finely-divided yellowish fatty matter, which, collected and washed, resembled wax. I return to the black matter obtained from the evaporated juice of manure, and which was insoluble in alcohol. This contained almost the whole of the soluble substances of the manure. This matter, on being dried, is black, fragile, and unchangeable in the air. Cold water readily dissolves it, reproducing the deep brown liquid, which restores the color of reddened litmus paper, and is precipitated by lime water, and by the soluble earthy and metallic salts.

The same matter, heated to redness in a crucible, leaves a coal which burns with difficulty. There finally remains a fused mass, presenting the characters of carbonate of potassa.

Treated by potassa, it exhales an odor of ammonia. From the preceding, we may conclude that the blackish matter of the juice of manure, which is insoluble in alcohol, results from the combination of potassa and a small quantity of ammonia, with a brown acid. The following are its properties :—Thrown down from the combination just mentioned, or from juice of manure, by an acid, and well washed, it reddens litmus. Being dried, it is black, and brittle, and has the lustre of jet. In this state, water has no influence upon it; but, on being hydrated, it communicates to this liquid a light brownish color. Alcohol has no tendency to dissolve it; when recently precipitated, however, from the juice of manure, it takes up a little of its fatty matter. Exposed to heat on a silver plate, it blackens this metal, owing to the sulphur it contains; burning with flame it leaves ochre-yellow ashes. It dissolved with the utmost facility in dilute alkalies, neutralising their properties; it decomposes the bicarbonate of potassa. The solution of this acid in an excess of ammonia, evaporated to dryness, yielded an ammoniacal combination with excess of acid, which was very soluble in cold water, reddens litmus paper, and on being treated with potassa disengaged ammonia. The same acid is soluble in acetic acid, chiefly when exposed to heat. At a common temperature it dissolves in nitric acid, rendering it of a deep brown color; water, on being thrown into this liquid, produces a kermes red precipitate. If the nitrous solution is exposed to heat *bitter yellow* (janneamer) results, which feebly precipitates isinglass. On distillation, the brown acid of manure furnishes a brown pyrogenous oil, soluble in the alkalies, and an aqueous alkaline liquid, which effervesces with acids and contains carbonate of ammonia.

The carbonaceous residue of this distillation, conveniently calcined with potassa and treated with water, furnished a liquor from which hydrochloric acid disengages a little sulphuretted hydrogen; the sulphate of peroxide of iron then produced a precipitate of prussian blue. From the properties of the brown acid of manure just enumerated, it appears that it differs from ulmic acid, because it seems to contain much nitrogen, and is, moreover, entirely insoluble in alcohol. I can only compare it to the azulmic acid of P. Boullay, which, however, seems not always to be identical with the blackish substance derived from the spontaneous alteration of hydrocyanic acid, a substance the acid properties of which have been controverted by Thénard; yet I do not venture to maintain that the brown acid of manure does not contain a little ulmic acid.

I have still to examine that portion of the black-butter manure which is insoluble in water. I diluted with water a determined quantity of this manure; at first, coarse quartzy sand was separated. The mixture, on being strained through linen, left more or less woody pieces of straw; these, on being well washed, were of a deep brown color, presenting the characters of turf, which, indeed, on being treated by a diluted solution of potassa, furnished a brown liquid from which azulmic acid was thrown down by the acids. The produce of their distillation was acid, and contained scarcely any ammonia. The turbid liquid which, on straining, passed through the linen, on being allowed to repose for several days, deposited an earthly sediment, but became by no means clear. There remained suspended a finely-divided, deep brown, turfy matter, which could only with the greatest difficulty be separated by the filter, as the latter very soon becomes obstructed. This matter, which on desiccation seems to have some lustre, differs from straw converted into turf merely by its extreme thinness. It is partially dissolved by potassa giving rise to ulmic acid, on distillation furnishing likewise an acid product. I calcined to ascertain the quantity of this matter and that of the earthy matters contained in the manure; but, without entering into further details, I think I am warranted in establishing that 100 parts of the manure black-butter are composed of the following substances :—

1. Water	72·20
2. Carbonate of ammonia, variable quantity, not determined	
3. Azulmate of potassa containing a little azulmate of ammonia..	1·15
4. Fatty matter analogous to wax united with ammonia and potassa	0·08
5. Carbonate of potassa	0·06
6. Chloride of potassium	0·21
7. Straw converted into turf.....	12·40
8. Turfy matter exceedingly divided, analogous to the preceding ..	3·63
9. Carbonate of lime.....	3·30
10. Phosphate of lime.....	0·45
11. Coarse quartzy sand.....	3·00
12. Earthy matter not determined..	3·52
13. Sulphate of potassa, phosphate of potassa traces	
	100·00

According to this analysis, it seems to me that the elements of black-butter manure most essential for actuating vegetation are azulmate of potassa and straw converted into turf; and, as the latter substance occurs in a great many localities, and frequently lies useless, it is easily conceived what advantages may be derived from it in preparing rotten manure without cattle.

The preparation of the azulmate of potassa presents no difficultics, for it is only necessary to boil in a brass pan a concentrated solution of potassa with a conveniently divided animal matter, as pieces of flesh, skin, horn, &c., and then, with continued stirring, to raise the temperature until the roasted matter begins to fuse, in the same manner as I indicated for converting sawdust into ulmine.*

The manure just analysed, however, containing but a little excess of potassa, care is to be taken that the one artificially prepared do not contain a much greater quantity; in a contrary case, it will, perhaps, be advantageous to obviate this inconvenience by admixing some plaster of Paris: but this substance must then be employed with caution, for, as has been stated, the azulmate of potassa is decomposed by earthy and metallic salts; and, in fact, a watery solution of sulphate of lime, or some powder of plaster of Paris put into this substance, will entirely decompose it. This is a fact which deserves the attention of agriculturists, for it will teach them that plaster of Paris inconsiderately employed may decompose the manure.

* *Annales de Chimie et de Physique*, série, t. xii., p. 190.

ON THE PRESENCE OF LEAD IN THE STATE OF OXIDE OR SALT IN VARIOUS ARTIFICIAL PRODUCTS.*

BY M. CHEVREUL.

I AM induced by several motives to publish some facts with reference to the presence of lead in the state of oxide or salt in various products of the arts, not because these facts of themselves are of great importance, but, on account of the many consequences which may be deduced from their knowledge, they present a certain interest.

I have had an opportunity afforded to me of pointing out to the Academy the inconvenience which may occur from treating woollen tissues with metallic matters, susceptible of producing with the sulphur which they naturally contain colored sulphurets, when these tissues are either to receive impressions on a white or light-colored ground, or to be dyed by similar colors, because under the influence of the heat of steam, or of the liquid serving as a dye bath, a colored sulphuret is formed spreading over all the portions of the tissues which are impregnated with the metallic matter. Some months back I was asked what might be the reason that the shawls woven in Picardy six months ago, on coming into contact with steam, become of a brown tint, even without having received any previous preparation. I soon found that the warp alone was colored, and as this was treated with isinglass, it appeared to me that the metallic matter was employed in the latter substance. Experiment confirmed my anticipation, for I discovered oxide of lead and a very little oxide of copper, not only in the sizing in the state in which it was employed, but likewise in the size itself from which this was prepared.

The proportion of the oxide of lead was so great, that the water in which the size was dissolved became strongly colored by sulphuretted hydrogen. I succeeded in obtaining the lead in its metallic state from the incinerated matter. After this experiment I learned that the size was prepared in the environs of Lille, and that ceruse had been added to it; fortunately, it was not of a nature to be employed as an alimentary substance. The communication, however, of this fact is interesting to manufacturers of woollen tissues, and with the view to be useful to them I thought it proper to give it all possible publicity.

Some years ago I was asked by a laundress of Sèvres (Madame P * *) whence came

* *Comptes Rendus*, 16th Sept., 1844.

the brown stains which appeared when she washed, for the first time, shirts, handkerchiefs, &c., made of cotton cloth. The loss which she suffered by several accidents of the kind induced her to find out the cause of them, and she discovered that these cloths came from one of the first manufactories in France, the Parisian agent of which was one of her customers. She sent to me a specimen of some new cloth, together with some of the alkaline matter, employed by her as ley, and which she obtained at La Villette. I recognised the presence of sulphate of lead in the dressing of the cloth; and, finally, having found that this alkaline matter was a mixture of highly-sulphuretted soda, potassa, and lime, I no longer doubted that the stains were produced by a reaction of the alkaline sulphurets on the sulphate of lead contained in the dressing. Without entering here into the question, how far cloth, impregnated with sulphate of lead, may be injurious to health, we think that the process of giving body and firmness to cloth by mixing sulphate of lead with the dressing ought by all means to be prohibited; and this is the more practicable, since, at present, for this purpose, in many establishments, sulphate of lime is employed without inconvenience.

I will make some remarks with reference to the investigation of metallic matters in human and animal bodies. In speaking of the boiling of the Dutch company (Compagnie Hollandaise), I quoted the experiments, from which it appeared to me that the copper which analysis may discover in animals or plants, is not to be considered as an essential element of their constitution. The quantity of this metal, though always very small, is variable, being sometimes altogether absent. If a cupreous salt penetrates the soil of vegetables by means of water, or a similar salt or cupreous powder penetrates with the food, or in any manner whatever the body of animals or of man, I consider this penetration as an accidental one. This is in conformity with the views expressed in my treatise on "*Matter considered as it exists in Living Beings*," in which I distinguished three classes of immediate principles—principles essential to the existence of beings; principles which, though necessary, are not essential, so that, if they are absent, others may supply their place finally, accidental principles which, without inconvenience, may be absolutely absent. I placed lead and copper among the accidental principles of the organised beings.*

* Flandin and Danger are of the same opinion.

I will now make some remarks with reference to the presence of this metal, deduced from analyses made under a circumstance of which I am about to speak. Having put some cloth, silk, and wool, to be used in the demonstration of my course (delivered last year at the Gobelins), in water rendered alkaline, it was noticed with astonishment that the wool became brown in waters containing soda, baryta, strontia, and lime, which were prepared for my experiments with perfectly pure alkali. I soon recognised the action of the oxide of lead under the influence of the alkali and sulphur of the wool, by the coloration of this latter body. But whence came the oxide which I found in the alkaline waters on treating them with sulphuretted hydrogen? It came from the flasks in which these waters were kept during several months, and it was evident that the glass of these flasks was a mixture of glass, properly so-called, and of *lead-glass*, called crystal. In the year 1828, I pointed out the error to which crystal glass might lead in legal cases, in treating, as was then usual, matters suspected to contain arsenic with carbonaceous matters in glass tubes containing oxide of lead. (*Vide* my Letter addressed to M. Lefrançais-Lalande, printed in a memoir of M. Guerre, Advocate at Lyons, for the defence of Mde. D**, indicted for parricide.) The same fact, I mean the existence of oxide of lead in glass, might lead to an erroneous result, not only in medico-legal investigations, but in any research whatever. Hence, to obviate any possible error, I call to mind the discussion raised by several chemists, with reference to the presence of oxide of lead in reagents, and especially in potassa prepared by alcohol.

According to M. Dupasquier, of Lyons, known to the Academy by his interesting labors in several branches of chemistry, the potassa prepared with alcohol, as sold by the manufacturers of chemical products at Paris, contains oxide of lead. According to M. Louyet, of Brussels, who investigated the absorption of deleterious substances by plants, the potassa prepared with alcohol by the firm of Robiquet, Boyveau, and Pelletier, is entirely free from them, containing, however, small quantities of alum, silica, and platinum.

Without pretending to obtrude myself as an arbitrator between MM. Dupasquier and Louyet, it evidently results from my own observations that alkalis, potassa, soda, baryta, strontia, and lime, though deprived of oxide of lead, on being kept dissolved in flasks of glass, containing lead, may dissolve a notable quantity of this oxide.

Finally, on terminating this note, I consider it useful to quote the following passage, extracted from a report laid before the Academy :—*

"The frequent use made in our days of several poisonous compounds, as those of arsenic, copper, &c., &c., must excite our attention, for it is possible, for instance, that waters which have served to wash substances impregnated with arsenical compounds, might in some place have a pernicious influence on animals. It is possible that the same effect might be produced by matters containing arsenic, which having been buried, and then disseminated by subterraneous waters, might be brought back again to the surface of the soil, at a distance from the place in which they were deposited."

The report in which the above passage is to be met with, was made by myself the 11th and 18th March, 1839, and the same year, being just then published, I read in the memoirs of the Royal Society of Sciences, Letters, and Arts of Nancy, for the year 1838, a note of M. Braconnot, superscribed, "On a circumstance which may cause error in the detection of arsenic."

Here follows the first part of this note :— "For about thirty years, during which a manufacturer of colored paper has prepared his colors with various mineral substances, several families living in the house adjoining his establishment have experienced in succession, with more or less intensity, the following symptoms :—headache, lassitude, nausea, painful digestion, almost continued colics, alvine dejections, swelling of the legs, discomfiture, and loss of spirits; in consequence of which affections, several members of these families died. Two years ago, new victims having suffered, a suspicion was raised that the water of the wells might contain some of the poisonous substances employed in the manufacture, but in the investigation which we then made, nothing was discovered, and the present inhabitants of this house continue to make use of the same water; they even sensibly recovered, but the above-mentioned symptoms manifested themselves with so much violence, that the case evidently appeared to be one of poisoning. M. Simonin and I were requested again to examine the water of this well, we then easily discovered the presence of arsenic associated with an alkali, alum, and a coloring matter."

M. Braconnot terminates his note by "earnestly inviting the authorities charged with the public health, to superintend, with the greatest attention, manufactures of this kind."

Had I had any knowledge of the note of M. Braconnot at the time when I compiled the above quoted report, I should certainly not have failed to mention it as a most strongly corroborative proof of the statements in the passage quoted above.

CONCLUSIONS.

1st. It is evident that woollen tissues should not be put into contact with materials containing lead or copper, when they are destined to be exposed to steam or hot water, to preserve a white ground, or to receive light colors.

2nd. Woollen tissues, or size, which served for the sizing of their warp, and cloth tissues dressed with a preparation of lead, which gave rise to the phenomena signalised in the above note, on being subjected to the test of liquid sulphuretted hydrogen, which I proposed some years since, produce a striking coloration, and this agent, consequently, is qualified to obviate all the inconveniences which might result from the presence of oxide of lead.

3rd. In future, in all chemical or medico-legal researches, in which the subject of investigation is lead or its compounds, it will, above all, be indispensable to subject the alkaline reagents to the proper experiments, to ascertain whether these latter bodies are free from oxide of lead, and whether they have received none from the glass vessels in which their solutions may have been put.

—nt—

* *Vide Comptes Rendus*, vol. viii., p. 380; the quoted passage is in p. 400.

ON A METHOD OF CONSTRUCTING A SIMPLE HYDROMETER.

BY EDWARD THOMPSON, AGENT OF THE COLLEGE OF CHEMISTRY, OTLEY.

CHEMISTS have frequently occasion to determine the specific gravity of a liquid when they have not access to an accurate balance and specific gravity bottle, and druggists may often find it convenient to be acquainted with a cheap substitute for an instrument which, as ordinarily purchased, is either expensive or extremely inaccurate. I think the simple contrivance which I am about to describe, may be found useful under such circumstances. The scientific reader will perceive that it is a modification of an instrument proposed long ago by Fahrenheit:—

Choose a light cylindrical four-ounce phial, and make a mark with a file or diamond completely round the lower part of the neck. Fit it with a bung which extends

considerably over the neck of the phial, and which is scooped out on the upper surface in the form of a cup. Then introduce into the phial so much shot or pieces of metal as will float the instrument up to the mark in distilled water, at the temperature of 60°, when a weight of about 500 grains is placed in the cork cup. Now, ascertain the weight of the instrument, including the phial, shot, and cork, and it is complete. When the specific gravity of a liquid is to be ascertained, pour out the liquid into a vessel sufficiently capacious to float the hydrometer, and add weights to the cup until the surface of the liquid exactly coincides with the mark. The specific gravity may then be found by the following proportion:—

As the weight of the hydrometer, added to the weight required to sink it to the mark in distilled water—

Is to 1,000:—

So is the weight of the instrument added to the weight required to sink it to the mark in any given liquid—

To the specific gravity of that liquid.

For example: Supposing that the hydrometer weighs 2,091 grains, that it is necessary to add 431 grains to sink it to the mark in distilled water, and that when immersed in a certain spirit of wine, 27 grains are sufficient for that purpose; then 2091 + 431 = 2522 and 2091 + 27 = 2118. Now as 2522 : 1000 : : 2118 : 839, the specific gravity of spirit.

It is evident that the operation of weighing the instrument and floating it in distilled water, when once accurately performed, need not be repeated, and that afterwards this hydrometer may be used where an accurate balance canot be obtained,

In Dr. Christison's valuable "Dispensatory," Art. Alcohol, there is a table, by means of which, if it were accurate, we might readily convert the specific gravity, as obtained by this and other instruments, into degrees of Sykes and Dicas's hydrometer, as used by the Excise. But from some experiments I have made, I am led to conclude that the table is not accurate. It is but just to Dr. Christison to observe, that he does not vouch for its correctness, but only introduces it as probably more correct than another which he mentions.

QUICK GROWTH OF WHEAT.

On the 1st inst., a field of wheat, which had been previously pickled with diluted sulphuric acid (containing 8 lbs. concentrated acid to the acre), was sown at Mr. Muspratt's farm, in Newton; the land having previously been manured with soda waste (fifteen tons to the acre). In two days the wheat sprung half-an-inch, and has since progressed rapidly.

IMPROVEMENTS IN THE PROCESS AND MEANS OF OBTAINING THE REPRESENTATION OF OBJECTS OF NATURE AND ART.*

PATENT GRANTED TO ANTOINE FRANCOIS JEAN CLAUDET, HOLBORN.

M. Claudet's improvements consist in rendering the Daguerreotype picture susceptible of producing, by printing, a great number of proofs or copies; thus transforming it into a complete engraved plate.

The process is based on the following facts, which have come to the knowledge of the inventor:—

1. A mixture, composed of water, nitric acid, nitrite of potassa, and common salt, in certain proportions, being poured upon a Daguerreotype picture, attacks the pure silver, forming a chloride of that metal, without effecting the white parts, which are produced by the mercury; but this action does not continue long. Then, by a treatment with ammonia (ammonia containing chloride of silver in solution is preferable for this operation), the chloride of silver is dissolved and washed off, and the metal being again in its exposed state, or cleansed from the chloride, it can be attacked afresh by the same mixture, which acts better warm than cold.

2. As all metallic surfaces, when exposed to the atmosphere, are soon covered with greasy or resinous matters, it is necessary, in order that the action of the acid on the pure silver may have its full effect, for the surface to be perfectly purified; this is effected by the employment of alcohol and caustic potassa.

3. When a Daguerreotype picture is subjected to the action of a boiling concentrated solution of caustic potassa before being attacked by the acid, the state of its surface is so modified that the acid spares or leaves, in the parts which it attacks, a great number of points, which constitute the grain of the engraving.

4. When the action of the acid is not sufficient, or, in other words, if it has not

* From the specification drawn by Messrs. Newton and Son, and published in Newton's *London Journal and Repertory of Arts*, Sept., 1844.

bitten deep enough, it is increased by the following process:

Ink the plate as copper-plate printers do, but with a siccative ink; when the ink is sufficiently dry, polish the white parts of the plate, and gild it by the electrical process; then wash it with warm caustic potassa, and bite in with an acid, which will not attack the gold, but only the metal in those parts which, having been protected by the ink, have not received the coating of gold. By these means the engraving is completed, as by the action of the acid alone it is not generally bitten in deep enough.

5. The following process is employed to protect the plate from the wear produced by the operation of printing:—The surface of the plate is covered with a very thin coat of copper, by means of the electrical process, before using it in the operation of printing; and when that coat of copper begins to show symptoms of wear, it must be altogether removed, by steeping the plate in ammonia, or in a weak acid, which, by electro-chemical action, dissolves the copper, without affecting the metal beneath it; the plate is then again, coated with copper by the same means, and is ready for producing a further number of impressions. This operation of recoating may be repeated *ad infinitum*.

The following is the description of the whole process, which is divided into two parts, consisting of a preparatory and a finishing process:—

PREPARATORY ENGRAVING.

For this operation, which is the most delicate, it is necessary to have—

1. A saturated solution of caustic potassa.
2. Pure nitric acid at 36° of Baumé's areometer, spec. grav. 1·333.
3. A solution of nitrate of potassa, composed of 100 parts of water, and 5 parts of nitrite, by weight.
4. A solution of common salt, composed of water 100 parts, and salt 10 parts, by weight.
5. A weak solution of ammoniacal chloride of silver, with an excess of ammonia. The ammonical chloride of silver must be diluted with 15 or 20 parts of pure water: this is the strength referred to in this description.
6. A solution of ammonia, containing 4 or 5 thousandths of liquid ammonia. This solution will be called ammoniacal water.
7. A weak solution of caustic potassa, containing 4 or 5 thousandths of the saturated solution, which will be called alkaline water.
8. A solution composed of water 4 parts, saturated solution of potassa 2 parts, alcohol 1 part, all in volume. This solution will be called alcoholised potash.
9. Acidulated water, composed of water 100 parts, and nitric acid 2 parts, in volume.

It is likewise necessary to have three porcelain capsules or dishes, large enough to contain the plate, and covered with an air-tight piece of ground plate-glass, and two or three more capsules which do not require to to be covered; two or three glass funnels to wash the plate; and two or three glass holders, of the shape of a spoon or shovel, by which the plate is supported when put in and taken out of the solution, without touching it with the fingers.

The Daguerreotype plate is submitted to the engraving process, after having been washed in the hyposulphite of soda, and afterwards in distilled water.

FIRST PROCESS FOR BITING IN OR ENGRAVING THE PLATE.

The following solutions must be put in the capsules in sufficient quantity to entirely cover the plate.

1. Acidulated water.
2. Alkaline water.
3. Alcoholised potash, in covered capsules.
4. Caustic potash, in covered capsules.
5. Distilled water.

The plate being placed on the glass holder or spoon, is plunged in the acidulated water, and agitated during a few seconds, then put into a glass funnel, and washed with distilled water. It is taken out again with the glass spoon, and plunged in the capsule containing alcoholised potassa. This capsule is covered with its glass cover, and then heated, by means of a spirit-lamp to about 144° F. The plate must remain in the capsule half an hour, during which time the solution is heated now and then, and agitated. During that time the following acid solution, which will be called normal acid, must be prepared: it is composed as follows:—

Water 600 parts, nitric acid 45 parts, solution of nitrite of potassa 12 parts, solution of common salt 45 parts. These proportions are in volume. The normal acid must be poured into a capsule, covered with its glass cover, and a sufficient quantity must be kept in the bottle.

When the plate has been immersed in the alcoholised potassa for half an hour, it is removed from the solution by means of the glass holder, and immediately plunged in the alkaline water, and agitated pretty strongly; from thence it is put into distilled water (A).

This being done, the plate is plunged in the acidulated water, and moved about in it for a few seconds: it is then put into the normal acid. When the plate has been im-

mersed for a few seconds in the acid, it is taken out by means of a glass holder, taking care to keep it as much as possible covered with the solution, and it is immediately placed horizontally upon a stand, and as much acid as the plate can hold is poured upon it from the bottle; it is then heated with a spirit-lamp, but without reaching the boiling point. During this operation it is better to stir or move about the acid on the plate by pumping it, and ejecting it again, by means of a pipette or glass syringe; after two or three minutes the acid is thrown away, the plate is put into the glass funnel, and there well washed with water, and afterwards with distilled water (B).

Then, without letting the plate dry, it is put upon the fingers of the left hand, and some ammoniacal chloride of silver, which is moved about the surface by balancing the hand, is poured upon it with the right hand, the solution is renewed until the chloride formed by the action of the acid is dissolved; the plate is then washed by pouring upon it a large quantity of ammoniacal water, and afterwards some distilled water (C).

Without allowing the plate to dry, it is then put into the caustic potassa, and the capsule being placed upon the stand, the potassa is heated to the boiling point; it is then left to cool (D); and again beginning the operations described from A to D, a second biting is obtained; and by again repeating the operations described in A and B, a third biting is produced. The plate is then dried; in this state the black parts of the plate are filled with chloride of silver.

The plate is then polished until the white parts are perfectly pure and bright. This polishing is effected with cotton and pumice-stone; afterwards, the chloride of silver, filling the black parts, is cleansed by the means described in B and C. The plate is dried, but before drying it is well to rub the plate slightly with the finger, in order to take off from the black parts any remains of an insoluble body which generally remains on it. The preparatory engraving is then finished, and the plate has the appearance of a very delicate aquatint engraved plate, not very deeply bitten in.

Nevertheless, if the operation has been well managed, and if it has been successful, it will be deep enough to allow a considerable number of copies to be printed with it.

Sometimes, instead of treating the plate with the boiling potassa in the capsule, a similar result may be obtained by placing the plate upon the stand, covering it with the solution, and heating it by means of a spirit lamp, until, by evaporation, the potassa becomes in a state of igneous fusion. By this means the grain is finer, but the white parts are more liable to be attacked.

LAST OPERATION OF BITING IN.

This operation requires some of the reagents before named, and also—

1. A siccative ink, made of linseed oil rendered very siccative by boiling it sufficiently with litharge; it may be thickened with calcined lamp-black.

2. An electro-type apparatus, and some solutions for gilding and coppering the plate.

MODE OF OPERATING.

The plate must be inked as copper-plate printers do, taking care to clean off the white parts more perfectly than usual; the plate is then to be placed in a sufficiently warm room, until the ink is well dried, which requires more or less time, according to the nature of the oil employed. The drying of the oil may be accelerated by heating the plate upon the stand with the lamp, but the slow progress is more perfect and certain.

When the ink is well dried, the white parts are cleaned again by polishing the plate with cotton and pumice stone, or any other polishing powder; a ball of cotton, or any other matter, covered with a thin piece of caoutchouc or skin, can be used for this purpose. When polished, the plate is ready to receive the electro-chemical coating of gold, which will protect the white parts.

GILDING.

The gilding is effected by any of the various electrical processes which are known. The only indispensable condition is, that the surface obtained by the precipitation must not be liable to be attacked by any weak acid; a solution answering this purpose is made of ten parts (by weight) of ferrocyanide of potassium, 1 part of chloride of gold, and 1,000 parts of water, used with a galvanic battery. During the gilding the plate must be turned in several positions, in order to regulate the metallic deposit. In some cases the gilding may be made more perfect, if the plate be covered with a thin coating of mercury before being put in the gilding solution.

When the plate is gilded, it must be treated with the boiling caustic potassa, by the process already indicated for the preparatory engraving, in order to cleanse it from all the dried oil or ink, which fills the hollows. The plate is then washed and dried, and when the oil employed has been thickened with the lamp-black, the surface of the plate is rubbed with crumb of bread, in order to cleanse and take off the black remaining; then, the white parts being covered

and protected by a varnish not liable to be attacked, and the black parts being uncovered and clean, the plate can be bitten in by aqua-fortis, according to the ordinary process used by engravers.

This operation must be done upon the stand, and not by immersing the plate in the solution.

Before this last biting-in, if the preparatory engraving has not succeeded well, and the plate still wants a sufficient grain, it can be given by the various processes of aquatint engraving.

Before employing the plate in the operation of printing, in order to insure an unlimited number of copies, it is necessary, as before stated, to protect it by a slight coating of copper, which is obtained by the electrotype process; otherwise the printing would soon wear the plate. This coating must be kept very thin, lest the fineness of the engraving, and the polish of the white parts, should be destroyed. In this state the plate can be delivered to the printer.

After a certain number of impressions have been obtained, it will be perceived that the coating of copper is worn in some places; then, this coating must be removed, and a fresh one applied in its place. For this purposed the plate must be purified and cleansed by a solution of warm potassa, and plunged in a weak acid, composed as follows:—

Water, 600 parts; nitric acid, 50 parts; nitrous acid of engravers, .5 parts; all in volume. This acid will dissolve the coating of copper, and the plate being coppered again, by the same means as before, may be again used in the operation of printing; and as nothing can prevent the success of a repetition of the same operation, any number of impressions may be obtained. The coating of copper can also be removed by caustic ammonia.

The Daguerreotype plate engraved by this process may be also reproduced and multiplied by the electrotype process, like any other engraved plate.

The essential points of this process, which constitute the present invention, consist—

First—In the discovery and employment of certain properties of a mixture composed of nitric acid, nitrous acid, and hydrochloric acid, in determined or fixed proportions. The two last-mentioned acids may be employed either in the free state, or combined with alkaline or other bases. This mixture has the property of biting the pure silver, which forms the black parts of the Daguerreotype picture, without attacking the white parts formed by the amalgam of mercury. The result of the action of the biting is, to form on the black parts of the picture an insoluble chloride of silver; and this chloride of silver, which, when formed, stops the action of the acid, is dissolved by ammonia, which allows the biting to continue.

Secondly—In the discovery of certain properties of a warm solution of caustic potassa, and in the employment of the said solution, by which the mercury forming the picture is better and deeper amalgamated with the silver under it, so that many imperceptible points of the amalgam are affected in such a manner that the acid has no action upon them.

Thirdly—In the discovery and employment of a process which produces a grain favorable to the engraving, by which the biting on the plate is rendered deeper. This is effected by filling the parts engraved with a siccative ink, or any other substance, and then gilding the plate by an electro-chemical process; the gold is not deposited on the parts protected by the ink. When the plate is gilded, the ink is removed by the caustic potassa, and the plate may be submitted to the action of an acid, which does not attack the coating of gold, but bites only on the silver in the parts already engraved by the first operation.

Fourthly—In the employment of a process by which the plate is preserved from the wear of the printing operation. This is effected by covering the plate, before printing, with a slight coating of copper, by the electrotype process, and when the coating begins to wear, by printing, it is removed by a weak acid, or by ammonia, which dissolves the copper without affecting the silver under it. The plate is coppered again, and after another printing, the same operation is repeated, so that a considerable number of copies may be printed without much injury to the engraving.

XANTHIC OXIDE DISCOVERED IN GUANO.*

BY PROFESSOR MAGNUS.

Professor Magnus communicated to me that Mr. Unger discovered in guano in his laboratory the substance called by Marcet *xanthic oxide* This body, so interesting to physiologists and chemists, has hitherto been found only twice as a morbid secretion,

**Liebig's Annalen der Chemie und Pharmacie*, Sept. 1844.

namely, as a vesical calculus. For the most minute investigation of this matter, we are indebted to Liebig and Wöhler, in their treatise on the nature of uric acid. They designated that substance by the name of *xanthin*, *urous acid (harnige saüre)*, but had at their disposal only a very small quantity of a calculus, part of which, moreover, *Strohmeyer* investigated before them.

Xanthic oxide is obtained from *guano*, on treating this latter substance by hydrochloric acid, and precipitating this solution by an alkali. From the precipitate obtained, a small quantity, but variable in amount, is extracted by caustic potassa. From its solution in potassa, xanthic oxide is either precipitated by a current of carbonic acid, or separated by the addition of sal ammoniac, when in proportion as the ammonia evaporates, it is separated. The pulverulent body thus obtained, presents all the properties which Liebig and Wöhler found in xanthic oxide, except that it is soluble in hydrochloric acid, as appears from the mode of preparation. But Mr. Unger found that, besides hydrochloric acid, xanthic oxide combines likewise with other acids, forming crystalline bodies, which are soluble in water, the description of which he intends to communicate on an early occasion.

Hence, guano, so remarkable with regard to its origin, and promising to become one day as beneficial to European agriculture as it has long been to certain countries of South America, likewise furnishes an interesting topic to science.

The small quantity in which xanthic oxide is found in guano, does not admit the assertion that it originates from slow decomposition; if, therefore, a proof be wanting for the assertion of de Humboldt, that guano consists of excrements of animals, this would be found in the very occurrence of the substance in question, which is known only as a morbid secretion of the animal organisation. The variations in the proportion in which it occurs in guano, render it very probable that it was deposited there as a morbid product in conjunction with the excrements of the birds, unless it be intended to assert that it enters into the composition of the normal fœces of animals. In the latter case, however, it would be highly interesting to become acquainted with this species of animals, which, perhaps, are still existing.

—nt.—

NEW METHOD OF CLEANSING METALLIC CLOTH, MORE PARTICULARLY APPLICABLE TO DAVY'S SAFETY LAMP.*

It is well known that the metallic cloth which surrounds the flame of the lamps used in coal-mines becomes very foul, in consequence of a mixture of oil, soot, and coal-dust insinuating itself between the meshes thereof; and as this clogging up of the meshes of the fabric causes a great diminution in the intensity of the light, it is found necessary to cleanse the same very frequently. For this purpose, the metallic cloth is exposed to the action of fire, which decomposes the oil and coal, and only leaves between the meshes a powder, which is easily removed by means of a dry brush. It is, however, impossible to heat metallic cloth to the degree required for decomposing the oil and coal, without bringing the same in contact with the air; by which means, in consequence of the oxidation of the iron, the wire is diminished in thickness, and the strength of the fabric consequently impaired.

Moreover, when the coal is of a sulphurous nature (as is often the case), the sulphur contained therein, being very destructive to iron, always renders the wire more liable to break. The consequence of this is, that the safety-cover, becoming thinner and more fragile, is much more likely to break from a shock, or even by the action of the flame; and thus the probability of accidents, which are of such frequent occurrence in mines, is greatly increased.

The following method of cleansing these kinds of fabrics entirely obviates the above-mentioned inconveniences:—Take a given quantity of carbonate of soda of commerce (which may be procured at a very low price), and dissolve it in water in a cast-iron vessel. To this solution is to be added a sufficient quantity of quick-lime, to deprive the carbonate of soda of the carbonic acid contained therein. The quantity of lime may be easily calculated by means of a table of chemical formulæ.

By sufficient boiling, a perfect reaction is produced; the carbonic acid combines with the lime, and forms an insoluble carbonate, and the soda becomes caustic. It is only necessary to separate the carbonate of lime from the caustic soda by filtration. In this solution of caustic soda, which is diluted more or less, according to circumstances, the foul metallic fabric is to be immersed. After remaining a short time (a few minutes

* *Bulletin de l'Industrie* and *Newton's Journal.*

will suffice) in this boiling liquid, the oil deposited in the meshes will be converted into soap, and the soot and coal be removed by being partially dissolved. When the meshes of the fabric are cleansed, it is to be brushed with a hard conical brush, which removes any substances that might have adhered thereto; after which the metallic fabric is to be wiped inside and out with a wiper, made of a sponge wound upon a stick, and in order to prevent the formation of rust upon the fabric, it is exposed to the heat of a coke or other ardent fire, until perfectly dry. It will be seen that the method of cleansing, above described, is very simple, and founded upon a well-known chemical reaction, but it will be found to possess considerable advantages over the method now in use.

In pointing out the advantages presented by Mr. Mueseler's lamp, M. Devaux, Chief Engineer of the Mines, acknowledges that the method of cleansing by fire diminishes the duration of metallic fabrics by one quarter. If, therefore, the results of this method shall be found successful on being practically tried, a great saving will be effected in mining operations, which ought not to be overlooked.

MODE OF ENGRAVING UPON OR ORNAMENTING STEEL AND OTHER METALS, BY MEANS OF ELECTRICITY.*

BY DR. J. H. PRING.

The means proposed by the author consists of an application of electricity, which he believed to be new.

The manner in which he has succeeded in producing marks or sketches upon plates of steel is as follows:—

He united six of Smee's batteries, in each of which the size of the plate of platinised silver was about three square inches. He fixed the plate of steel to be engraved upon at the zinc end of the batteries. Having placed a wire of considerable length, covered with silk, between the plate of steel and the zinc, he took hold of the wire in communication with the platinised silver, and used it as a etching point on the plate of steel. A bright electric spark, accompanied by a slight attack upon, or bite into, the steel, was the result each time the wire came in contact with the plate.

The wire, which served as a graver, was made of platinum; the part which he took hold of was enclosed in a glass tube, in order to facilitate its being more easily taken hold of and moved, and to protect the hand from the electric shocks to which, without this precaution, it would be exposed.

In using the wire, in communication with the zinc, as an etching point, and attaching a plate of steel to the platanised silver, a totally different effect is produced. With the apparatus thus arranged, the spark resulting from the contact of the wire with the plate of steel, is accompanied by the deposition of a very small portion of the wire itself upon the steel. By employing wires of different materials, such as gold, silver, platina, &c., a variety of ornamental designs may no doubt be produced upon surfaces of polished steel.

The effects of the electrical influence above described are not confined to steel; a nearly similar result may be obtained by substituting plates of any other metal. It is to be presumed, that by augmenting the quantity and intensity of the electric currents, the effect upon the steel or other metal would be proportionably greater; and it is very probable, that by modifying the process, its application might be advantageously extended.

* *Bulletin de l'Industrie.*

APPLICATION OF ELECTRICITY TO THE IMPROVEMENT OF THE MANUFACTURE OF IRON.*

"The attention of the iron-masters has been attracted to a process of considerable importance lately introduced into their manufacture. The application of electricity, to supersede several of the expensive processes, which has, it is stated, been tried in the Welsh and Derbyshire furnaces with satisfactory results. It appears that the costly fuel and labor required for the purification of the ore from sulphur, phosphorus, and such subtle elements, create its high market value; and these, being all electro-negative, have induced the new process, whereby the impure stream of metal, after flowing from the blast, is in its moment of consolidation subjected to a powerful voltaic battery, which so disengages the impure components that in the process of puddling they are readily extracted. The London blacksmiths, it is stated, have tested this iron after a single reheating, and pronounce it equal to the best metal in the market. By the same process an experiment was tried by Dr. Ure, by whom a soft rod of iron was held in con-

* From *The Mechanics' Magazine*, No. 1,097, Aug. 17, 1844.

tact with a moderate red heat, and that gentleman is understood to have stated that in a few hours the metal was converted into steel. Should these facts prove what they seem, they are calculated to effect most seriously this important branch of our trade."

The process referred to in the above extract, is that for which Mr. Arthur Wall obtained a patent, November 18th, 1843. It is thus described in his specification, enrolled May 18th, 1844:—

"In casting a bar or similar mass, the electric current is caused to traverse from end to end, by conductors so arranged, that when the metal runs into the mould it may complete the electric circuit, or by means of a wire or wires, passed from one end of the mould to the other. If the castings are horizontal, a piece of wrought iron or other conducting material is placed at each end of the mould, which is made of sand, or other non-conducting substance; these conductors are then connected by wires with a galvanic apparatus, or voltaic pile, or electro-magnetic or other battery; so that, when the melted iron is run into the mould, it will complete the electric circuit; and the patentee prefers to continue the electric current for some time after the iron has solidified. When the castings are vertical, a similar arrangement is made for the passage of the electric current through the metal by placing a conductor at the top and bottom of the mould, in such a manner that the electric circuit will be completed the moment the mould is filled with liquid iron.

"To apply electricity to iron in a smelting furnace or cupola, a wrought-iron rod is introduced through or at the side of the tap-hole, until it comes into contact with the melting metal, and another wrought-iron rod is introduced at the upper or posterior part of the hearth, or through one of the tuyere holes, until it reaches the metal; the outer ends of these rods being then connected with a battery, the electric current will be caused to pass through the iron, care being taken not to continue it so long as to entirely decarburate the iron, and bring it to a malleable state. When the electricity is to be applied to the iron in a puddling or balling furnace, two iron rods are also used, one of which is inserted into the fused metal, and the other end is connected with a battery; the other rod is attached to an insulating handle of porcelain, pottery, or other non-conducting substance, and a wire from the battery is connected to it, close to the handle. By means of the handle, the extremity of the rod is caused to traverse the iron in its melted state, or during its transition to the solid state, and the electric current will therefore pass through the metal in every possible direction."

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

TREATISE ON THE PASSAGE OF SOME MEDICINES THROUGH THE ANIMAL ECONOMY, AND ON THE MODIFICATIONS WHICH THEY UNDERGO THEREIN.*

BY MM. LAVERAN AND MILLON.

CHEMISTRY furnishes materia medica with the active principles, by which we are enabled to establish with certainty the nature and doses of medicines. Notwithstanding this new expedient so properly determined with reference to a great number of medicinal substances usually employed, we are yet frequently embarrassed by the instability of therapeutical actions. It appeared to us interesting to observe the medicine after it had been submitted to the capricious influence of the organs, to notice the transformations the moment it leaves the economy, and the physiological effects produced, and to ascertain in that way, as far as possible, some useful mutual relations. This is the object of the researches which we have the honor to submit to the judgment of the Academy.

Most of our observations refer to the administration of the tartrate of soda and potassa. We observed 268 ingestions; sulphate of soda has been given 15 times, sulphur 4 times, salicine was taken by 10 patients.

In all these observations we prepared the medicines ourselves; their doses and ingestion were carefully superintended. We endeavored likewise to be as accurate as possible with regard to the examination of the disease, the determination of its nature and different stages.

* *Annales de Chimie et de Phisique*, October, 1844.

It will appear in the sequel by what motives we were guided in experimenting on the choice of medicines. The investigation of substances administered on leaving the economy extended merely to the products of the urinary secretion.

Tartrate of Soda and Potassa.—This salt, very much employed in the days of Lemery, then called salt of Leignetti, figures still in the materia medica as a gentle purgative. It was given in 30 to 50 grammes (from 1 to $1\frac{2}{3}$ of an ounce) without creating the slightest inconvenience. The administration of this salt fixed our researches on a point which justly excited the attention some years since. We allude to the conversion of organic salts of soda and potassa into carbonates of the same bases. Since the observations, due to Wöhler, have been made on animals, with reference to alkaline tartrates, citrates, and acetates, their transformation into carbonates has been considered as an invariable phenomenon. The conversion, however, is of extreme instability: in the sequel a most general idea of the matter may be conceived by the results which we obtained. Of 268 ingestions of the double tartrate, 175 were followed by urine to a more or less degree of an alkaline reaction, 87 urines were acid, and 6 urines sensibly neutral. On following certain rules the whole of the salt of Leignetti may be expelled by the intestinal tube; the passage of the salt by the urine is then a very rare case. On the contrary, we may cause the same salt to penetrate the absorbent vessels, and in that manner saturate the urine with enormous doses of the alkaline carbonate. The evacuation of the tartrate by the intestines becomes then an exception; and, if it happens at all, the tartrate is but incompletely eliminated by alvine evacuations.

If the greater part of medicines is subject to similar variations, and it can hardly be presumed that it be otherwise, it appears how important it must be for the healing art to throw a light on the means of avoiding this, or occasionally to turn it to advantage.

The alkaline nature communicated by the Leignetti salt to the urine may most exactly be appreciated by the normal sulphuric acid employed by Gay Lussac in the assays of soda and potassa of commerce. The urine is collected in proper vessels, and kept at a low temperature, if the experiments are made in the hottest season. The urine of 24 hours was measured, or separately each time of emission; of this 1 decilitre (3 ounces) was colored blue by tincture of litmus; and then from the vessel for alkalimetrical essays the sulphuric acid was thrown into it drop by drop. When the tincture becomes of the red which is proper to sulphuric acid, the operation is discontinued.

For further information, we refer the reader to Gay Lussac's instructions.

It was necessary to ascertain whether, in the case of the urine being acid or neutral, the soda and potassa notwithstanding escaped in combination with undecomposed tartaric acid, or any other organic acid. It was likewise possible that one portion of the alkalies was contained in the urine as a carbonate, and another in combination with some organic acid.

To ascertain this, a given weight of the urine is to be evaporated to siccity, this result calcined, and then the charcoal obtained burned in the open air. If we desire to determine by this operation the quantity of salts contained in the urine, we always find that the complete combustion of the carbonaceous matter is very difficult, offering a particular obstacle by the presence of the alkaline carbonates. By a simple process we removed the causes rendering the operation slow. When the direct calcination is somewhat advanced, we with precaution let fall from a phial, previously weighed, a little of finely-powdered chlorate of potassa; in some instances the residue becomes white. The quantity of chloride of potassium answering to the quantity of the chlorate employed must then be subtracted.

With particular reference to the salt of Leignetti, we chiefly endeavored to determine the quantity of alkali contained in the residue left on calcination. We ascertained—1st, that the quantity of the alkaline or earthy carbonate obtained, on calcination of a normal urine saturated, from 15 to 25° of the alkalimetrical vessel; 2nd, that this proportion of alkali was not augmented in urines which were of a neutral or acid reaction, in consequence of the administration of the tartrate of soda and potassa; 3rd, that the urine rendered alkaline by the administration of the same salt, gave residues in which the quantity of alkali indicated in the fresh urine was augmented only by from 15 to 25 alkalimetrical degrees.

It was therefore invariably the case that the salt of Leignetti was not eliminated by urine in the state of tartrate, and that such as entered this channel was entirely converted into a carbonate.

After having established these first bases, we were able in the months of December, 1843, January, February, March, and April, 1844, with very great exactness, determine the acid, neutral or alkaline state, and the degree of alkalinity of 268 urines rendered subsequently to the administration of the salt of Leignetti; in the case of the conver-

sion of the alkalinic tartrate into a carbonate, we found it an easy matter to refer it to the dose, the mode of administration, the state of the organs, and the individual dispositions.

When the salt of Leignetti was taken in short intervals and large doses, 40—50 grammes (1—1⅔ ounces) at one time, it tended to concentrate its effects in the digestive organs. Vomiting was very rare, but the ingestion was always followed by several liquid openings of the bowels. When the patients experienced nothing with reference to the intestinal tube, the case was an exception; but then the urine rendered was alkalinic.

Prescribed on the contrary in small doses, or in refracted doses, so that 15, 20, 30, or 40 grammes (½, ⅔, 1—1⅓ ounce) were taken within eight or ten hours, the tartrate produced effects of an opposite nature. In this case the purgative virtue was the exception; the alkalinity of the urine became the habitual state; one litre (2 pounds) of urine could saturate 250 divisions of the alkalimetrical vessel; therefore considering merely the tartrate of soda and potassa, we find that on administering it in large doses, it is directly expelled by the movements of the intestines, and by the liquids secreted on the surface of the mucous membrane, covering it, whereas small quantities of it, though repeatedly taken, penetrate the economy, are transformed by it, the combustible portion of their elements being brought to the last stage of oxidation, and finally eliminated by the urine in the state of alkalinic carbonates. In the first case it is indigestion; in the second, assimilation, secretion; there it is rather a medicine, here a nutritious substance.

Still here the difference of action was to be found in the dose, according to the part acted by individual disposition and the various states of organisation.

Robust people affected with slight indisposition are best qualified to digest the tartrate. It is in this category that we meet with cases in which, notwithstanding the salt of Leignetti was administered in a large dose at once, it was by way of exception partially digested. Feeble subjects show a contrary disposition; the purgative effect takes place. In cases of the kind, notwithstanding the fractioned doses, we may even arrive, though rarely, at obtaining urines of an acid reaction. Habitual constipation, even that which depends on an apparent disease of the brain or medulla, was a condition promoting the absorption: a patient attacked by a cerebral apoplexy, without being purged digested 40 grammes of the tartrate taken at one dose; a litre (2 pounds) of the urine saturated 150—190 divisions of the alkalinimetrical vessel.

Individuals suffering under derangements of the digestive canal, or diarrhœa, have very little capacity to absorb the salt of Leignetti, and in this latter case the urine is almost always acid. The same happens when the chief affection is fever. Notwithstanding, however, the most unfavorable conditions for the combustion if the double tartrate be present, this substance may yet be forced to penetrate into the organs of absortion. We arrive to that first by fractioning the doses, next by continuing to employ this salt; the first day the urines are acid, the second and the third already decidedly alkaline. In following the simple rules just indicated, we sometimes met with several of the anomalies known to physicians and observers in general. A case of the kind was that of a man laboring under acute pneumonia. He digested one ounce of the salt of Leignetti administered to him at one time, and his very abundant urines saturated 120 divisions of the alkalimetrical vessel; but by a remarkable coincidence the patient continued to have appetite.

The means of transforming the double tartrate into an alkaline carbonate being well established, we examined which use the healing art might derive from this circumstance.

Here it must be said that we hoped to find in the passage of the alkaline carbonates into the circulation a means of modifying those diseases, in which the blood is distinguished by its greater plasticity, and excess of fibrin. Hence we made our first experiments with patients laboring under acute pneumonia and articular rheumatism. The resistance which in some cases was hindering the absorption on being removed, we analysed the blood by the method contrived by Dumas, and made popular by the publications of Andral and Gavarret. But on having analysed the blood of ten venesections, were obliged to admit that the quantity of fibrin did not diminish, and that the cupping was just as strong as when no tartrate was administered. In the greatest number of patients, however, the proportion of urea was considerably augmented, which indicates a more rapid combustion. We ought, perhaps, to have longer continued chemically to examine the blood; but it became evident to us that, notwithstanding the formation of the alkaline carbonate, the acute rheumatisms and pneumonies followed the ordinary course. We preferred remaining within prudent limits, though it may appear to have been too scrupulous, and interrupted our researches in such a grave

matter, when there was no other motive than a kind of scientific curiosity.

The increase of the oxidating power, rendered evident by the presence of the urea in excess in cases most unfavorable to the absorption of the salt of Leignetti, led us to a new series of experiments. By this we may find the therapeutical application of the double tartrate, considering the rules which we laid down when speaking of its conversion into the alkaline carbonate.

The acceleration of the oxidating powers led to the administration of the alkaline tartrate in cases in which it was requisite to raise the languishing nutrition. Its efficacy, under similar circumstances, was generally most fully confirmed. We confine ourselves to quoting some instances proper to show this effect in all its clearness.

A patient, laboring under hypochondriacal monomania, was much weakened, and rendering daily from 6 to 8 pounds of urine. This liquid, being less dense than in its normal state, in a cold temperature deposited carbonate of lime; on boiling, a fresh quantity of carbonate of lime was separated, and urea was only in a very inconsiderable quantity contained therein. Under the influence of the administered tartrate, according to the method of absorption, the urines were brought back to their normal quantity; their density, and the desirable physiological constitution restituted. The health of the patient, on the whole, improved remarkably, but the monomania did not disappear.

Another patient, laboring under a heavy albuminuria, was treated by the tartrate; the albumen disappeared in the urines, they were reduced to their normal proportion, but this known dreadful disease, however, went on in its course, and the patient was lost—a proof that the insufficiency of the healing art goes beyond the actions of the secondary phenomena of life.

Several patients affected with phthisic, their fever being moderately strong, absorbed the double tartrate with facility, without experiencing any fatigue in their organs. The whole of their functions were ameliorated; we are far from thinking that there was more than a transitory amelioration, but this was obstacle enough to our observation, for the patients leaving the hospital, ceased to be the objects of our investigation. With some of these phthisical patients the use of the salt of Leignetti was followed by more calmed respiration and circulation. In one case the pulse descended from 90 to 40 pulsations and remained at that number for longer than a fortnight.

It may easily be conceived how much we were desirous, methodically, to examine the action of the double tartrate in diseases characterised by an abnormal secretion of uric acid. This is most commonly the case of gravel and urinary calculus, the administration of the salt of Leignetti appearing admirably qualified to act against these affections. It communicates, indeed, a particular activity to digestion; and the alkaline carbonate produced is very proper for dissolving the uric acid, and this carbonate penetrates in a dose which may amount to 15 or 20 grammes in 24 hours. We may add that the medicine may be absorbed together with the food; and as this latter seems to be the most direct cause of the evil, the remedy is produced in the very source of the affection. These views are finally confirmed by what is commonly practised in cases of gravel and calculus, namely, the use made of red fruit. The salt of Leignetti offers the active principles of these latter substances in a constant form, which may be given in any desired dose, and in any circumstances appropriated to the individual dispositions.

The insufficiency of military praxis prevented us from practically examining these views, which, however, follow of themselves; but they will not fail to receive the control of experience on another occasion.

ON THE ADMINISTRATION OF SULPHATE OF SODA, SULPHUR, AND SALICINE.

After having examined the transformation of a medicine which was partly burned, and, to a certain extent, contributed to nutrition, we wished to observe the passage of a substance, the elements of which, being strongly oxidated, could, in the animal economy, undergo no new oxidation. We selected the sulphate of soda. The urines normally contain sulphuric acid, the proportion of which was determined. Eight analyses, made with urines of adults, collected at various hours of the day, induced us to admit that this proportion varies from 2 to 2½ grammes per litre (0·2 to 0·25 per cent.), supposing the anhydrous sulphuric acid to be SO^3.

It will not be necessary to enter into long details in our observations. We sum them up in saying that the sulphate of soda follows in its passage the same laws as the salt of Leignetti. Taken in fractional doses by individuals strongly constituted and but slightly indisposed, the salt is absorbed and eliminated, unmodified only partially by the urines. We made from 10 to 15 grammes of sulphate of soda pass into the urine.

It would have been easy to augment even that quantity, but without profit for the observation.

Under contrary circumstances: a feeble subject, one strong dose being administered, the fever still in activity, and the digestive organs deranged, the urines contain only the normal quantity of sulphuric acid. Nothing of the sulphate of soda was introduced.

With reference to this salt, it cannot be overlooked that the action of the organ of absorption is analagous to combustion.

The administration of sulphur furnished us with negative results. It seemed neither to burn nor at all to enter into the economy. In making use of the analytical means, most proper to discover it in whatever combination it may exist, it could not be detected. In four cases in which it was ingested by individuals endowed with a proper absorbing disposition, the urines contained only the normal quantity of sulphuric acid.

With regard to salicine, we have been induced by its inertness in a therapeutical point of view, signalised already several times to administer it only in some cases of slight intermittent fevers. It was interesting to ascertain whether this substance, which is entirely combustible, but which contains a strong proportion of carbon, and very notably differs from other alimentary principles, does not undergo a peculiar transformation.

Experiments repeated ten times gave always the same result.

The urines following the ingestion of salicine, contain all hydruret of salycile or satycic acid. We could find no means exactly to determine the amount of these two substances, and to find out the relation between their quality and that of the salicine employed. But the characteristic reaction which the hydruret of salycile and silicic acid produce with the persalts of iron, is invariable. The violet coloration is most intense. It is found in the produce of distillation of the urine, both in its alcoholic and etheric extracts; even crystals of salycic acid may be extracted from the urine without much trouble.

A fact of this kind shows the variety of principles which a carefully instituted chemical investigation may enable us to discover in urines; but it is, moreover, remarkable to notice, how the oxidating powers of the economy act on salicine, producing, of the organic elements contained in this substance, bodies identical with those obtained in laboratories. Our organs in the action of combustion, work like a mixture of sulphuric and chronic acids, or rather like potassa in a state of fusion, viz., as the most energetical oxidating agents. It is, undoubtedly, a very restricted instance of the great phenomenon of combustion, which every where accompanies the phenomena of life; but by the simple fact of the transformation of salicine, by the striking reaction by which it is discovered, the principal demonstration seems to gain more ground.

—nt.—

FATAL CASE OF POISONING WITH CARBONATE OF LEAD.*

Mr. Snow read a paper before the Westminster Medical Society, on a case of this kind, which came under his notice in May last. A child five years of age ate a portion, not so big as a marble, of white lead, ground up with oil, on a Saturday night: on Sunday, Monday, and Tuesday, he suffered from pain in the abdomen, and costiveness. His parents, thinking what he had eaten was putty, did not consider his illness dangerous, and did not apply for advice, but gave several doses of purgative medicine; and the bowels were moved on Tuesday evening, for the first time. During Tuesday night the child became rapidly worse, and vomiting was added to the other symptoms. Mr. S. was called in on Wednesday morning, and found him vomiting constantly a brownish liquid, streaked with blood, and complaining of great pain, chiefly in the epigastrium. His face was swollen and purple, and there was effusion of apparently coagulated blood under the conjunctivæ, and oozing of blood from the nostrils, and the body was spotted with petechiæ. The gums were tense, and very white. Pulse 140, and hard; skin hot. Leeches were applied to the epigastrium, and an emulsion containing Epom salts was given; but he got rapidly worse, and died within five hours of the first visit, and about ninety hours after taking the poison. He passed some very offensive motions, of a peculiar greenish black color, before he died.

An examination of the body was made eighteen hours after death. A considerable quantity of serum, deeply tinged with blood, was found in the pericardium, both pleuræ and the peritoneum. There was ecchymosis of the surface of the lungs, and they were engorged posteriorly. The heart, as well as the liver and kidneys, was soft and flabby, and there was a little red fluid blood in the ventricles. The œsophagus was healthy, except two spots of ecchymosis near its lower end. The stomach exhibited marks of intense inflammation, the mucous membrane being much injected, and of a very dark-red color throughout all its extent. The rest of the alimentary canal was healthy, except a little redness of the cœcum. Poison could

* *Lancet*, October, 1844.

not be detected in the contents or tissue of the stomach, or in the matter vomited.

In the authors to whom he had referred, he (Mr. S.) had not met with a fatal case of acute poisoning by carbonate of lead. Dr. Taylor related a case attended by Mr. Cross, in which a woman took six or eight drachms, by mistake, and recovered under the use of remedies; and Dr. Christison quoted from a German journal the case of a young woman, who swallowed, accidentally, an ounce and a half, without any bad effect whatever, either at the time or afterwards; that it was very poisonous, however, we had sufficient evidence, for the carbonate was the form in which lead was introduced into the system of painters and most artisans who suffered from it. In the case quoted from Dr. Taylor, and in the cases recorded of poisoning by the other salts of lead, vomiting, and other symptoms of violent gastric irritation, came on soon after the ingestion of the poison; but this child seemed to suffer only from lead colic for the first three days, and the gastritis appeared only to come on, or at least to become severe, about twelve hours before he died. This, probably, depended on the incorporation of the white lead into a tough mass, with oil, which might retard its effects, and cause it to act only by little and little in proportion as it became digested.

Mr. Hancock remarked that the symptom of relaxation of the sphincter ani in the case detailed, had been considered by Mr. Snow as very remarkable and unusual. Now, he (Mr. H.) had repeatedly seen that condition of the muscle in question in cases of concussion of the brain, and of injury of the spinal cord, the relaxation continuing in some cases for several days, and the patients ultimately recovering.

Mr. Snow replied that his observation with reference to the sphincter ani had reference to cases of acute disease, in which the brain and spine were not primarily involved. He still thought that, in cases of that description, it was very unusual to find the sphincter relaxed.

Dr. Chowne said that the question mooted by Mr. Snow respecting the relative poisonous powers of carbonate and acetate of lead, was one of much importance. His own opinion was, that the carbonate was most poisonous. The effects of carbonate of lead, when dissolved in water and drank, were well known. Fortunately, however, this accident was unlikely to occur, for it was only when water was quite *pure* that lead became soluble. As commonly received into our cisterns, water had no chemical effect on lead, because the fluid held some neutral salt in solution. It must be remembered, also, that anything like galvanic action prevented the decomposition of the lead, and this galvanic action might arise from the presence of a few iron nails. Cases of poisoning by acetate of lead were more frequent than those by the carbonate. The sphincter ani was seldom relaxed in cases of poisoning by carbonate of lead; a case was recorded, however, in which the use of a lead lotion to hæmorrhoids produced relaxation of the sphincter.

Mr. Brooke recollected examining a man who had died from the effects of lead colic. There was a very unusual appearance of the pleuræ, both of which were remarkably dry and shining, and though the costal and pulmonic layer were not adherent, they were in very close contact. The body was examined the day after death.

Mr. Seaton referred to the poisoning of the Queen's hounds by carbonate of lead, in consequence of the water they drank passing through leaden pipes, and observed that in this instance the lead could be separated by repeated filtration.

Dr. Chowne, in reference to the effect of lead on the gums, had seen a great number of instances in which the blue line on the gums was present without any evidence whatever that lead had been taken into the system; and he had seen even lead colic in which there was no tinge of the gums. Inquiries and observations, indeed, most carefully directed to this point, had convinced him that the presence or absence of the blue line on the margin of the gums had no certain connexion with the administration or non-administration of lead. One of the most severe cases of paralysis he had ever seen had arisen from the inhalation of lead; the patient was a tailor, who had worked in a room which had been recently painted. Cases of poisoning by acetate of lead were not uncommon; they were seldom fatal, although as much as an ounce of the lead had been in some instances taken.

Mr. Snow said that the dryness of the pleuræ, in Mr. Brooke's cases, was probably owing to other causes than the lead; the dryness was an evidence of inflammatory action. In his own (Mr. Snow's) case, the cavity of the pleuræ contained a quantity of serum.

Mr. Wells related some cases in which all the symptoms of poisoning by acetate of lead resulted from drinking porter which had passed through leaden pipes.

Mr. Harding said, that the doses of the acetate of lead, as ordered in the *Pharmacopœia*, were, as a general rule, much too small. In active hæmorrhage this medicine

might be administered in very large doses with perfect safety. He had seen as much as thirty to forty grains of it given in the course of a day with the best results.

Mr. Snow said, that the danger of the acetate of lead consisted less in the largeness of the doses than in the long continuance of small doses.

Mr. C. Chowne related a case in which an ounce of the acetate of lead was swallowed in mistake. The patient had an emetic administered, followed by Epsom salts, and quite recovered.

ON THE PREPARATIONS OF IRON RECENTLY INTRODUCED INTO PRACTICE.

The preparations of iron are most deservedly in high esteem with practical medical men. The reputation of these preparations, in the treatment of diseases, has probably varied less for a long time past than that of most remedies of similar pretensions. There are, indeed, some indications of their having been held for a time, since the commencement of this century, in a degree of suspicion with a part at least of the profession. And this suspicion seems to have arisen from their well-known power of acting as a stimulus to the vascular system—of increasing the force and frequency of the heart's action—a property which was naturally enough thought to be incompatible with their use in any chronic disease, where by possibility there might be inflammatory action secretly going on.

But it seems now well established that there are chronic diseases attended with some degree of the inflammatory process—for example, chronic inflammation of the mucous membranes, chronic diarrhœa, chronic dysentery, enlargement of the liver or spleen, and ulcerations of the surface, in which those conditions are present that determine the utility of the preparations of iron. Besides, it was more the practice some years back than it is now to describe morbid alterations of tissue, such as so often characterise chronic diseases, to inflammatory action. And if the recent introduction of the term *diseased nutrition*, to represent a part of the morbid agency in the production of textural alterations, before referred to inflammatory action, has been of no other use, it has at least left us more free to observe the effects of remedies on many chronic diseases, without the bias given to the mind by the ideas which inflammation cannot but call up.

As respects the preparations of iron, however, in diseases generally, the risk at present is, from the universal attention paid to them, that their use will be carried beyond just bounds, rather than that they shall be employed less than they deserve.

And yet the indications for the use of iron in diseases have always been tolerably simple, and perhaps it is not premature to pronounce that these are already becoming still more simple than before. We refer to the exact evidence recently brought forward of what has been conjectured for many years past—namely, that iron used as a remedy goes directly to the nutrition of the blood, when the blood has fallen into an impoverished state. On this subject the memoir of Andral and Gavarret is highly interesting, as well as Andral's more recent little work, entitled "Hematologie."

It is hardly too speculative, when we look to the facts detailed in the memoirs just referred to, to represent the state of the system which calls for the use of iron in the following manner:—The iron of the blood, in the healthy state of the system, is drawn from the organic matters containing it employed as food; but in certain states of ill health the nutritive powers become inadequate to extract a sufficiency of iron from the ordinary food, for the maintenance of the blood in its perfect state; while, if iron be given in the mineral state, the blood becomes restored more or less quickly to a healthy constitution. Thus, then, under this view, iron becomes an aliment rather than a medicine; or, like common salt and water, it is an aliment from the mineral kingdom.

Hence, besides the old indications for the employment of iron drawn from the languor of the circulation, the inactivity of the respiratory acts, and the depression of the nervous system, we obtain in addition the impoverished state of the blood or the proportionate deficiency of the red corpuscles—a deficiency which may be ascertained with or without the use of the microscope. The same view affords a satisfactory rationale of the difference between the effects of iron as a stimulant on the living system and those of such stimulants as alcohol, opium, and the like. The latter agents, like iron, increase the force of the circulation, the activity of the respiratory acts, and the energy of the nervous system; while digestion, secretion, and absorption, participate in the general excitement, and the whole system feels a fresh tone. But these effects are short-lived; there is expended on them much of the ordinary resources destined to maintain the body in vigor for some time to come, and hence, present exhaustion must ensue. There is a collapse of the system, marked by languor of the circulation, de-

ficiency of respiration, abatement of the healthy vigor of secretion, and depression of the muscular tone.

And the reason is, because the last-named stimulants possess little or no nutritive property. The excitement they produce is necessarily, therefore, a process of exhaustion; unless, indeed, the system has previously fallen below its healthy standard, in which case such stimulants act the part of permanent tonics, by bringing the functions of maintenance nearer to the level of healthy vigor. But the preparations of iron, under the view above referred to, not only stimulate, but at the same time supply to the blood the means of sustaining the expenditure of substance produced by their stimulus.

But enough of these generalities: we propose to give a short notice of the preparations of iron recently brought into use.

Notwithstanding the difficulty of preventing the protosalts of iron from passing spontaneously into the corresponding persalts, a very general belief has sprung up that the former are of greater utility in a medicinal point of view than the latter. It is true that the rust of iron and the old precipitated carbonate are known by long experience to be beneficial in diseases, and it is equally certain that the discovery of chemists that they are not carbonates cannot invalidate their claim to this title. Why, then, it may be asked, take so much pains to exhibit iron in the form of a true carbonate, if there be no experience till of late of its utility, while there is the experience of many years in favor of the sesquioxide into which the carbonates spontaneously pass? But since it is quite possible that, while the sesquioxide is useful, the true carbonate may be more useful, let us consider on what ground of experience the latter persuasion rests. The antihectic mixture of Griffiths, represented officinally by the compound mixture of iron and by the compound iron pills, has, from an early period, enjoyed a high reputation among practical men, in spite of the efforts of chemists and pharmaceutists, who rest their opinions on theory too little qualified by experience in the actual treatment of diseases, to banish it as unscientific.

It is now found that this supposed unscientific mixture is the only form in which we have any long experience of the medicinal effects of iron in the state of carbonate. And hence arises a probability that the reputation of the compound iron mixture in diseases depends on the iron being in the state of carbonate of the protoxide. It is retained in that form by the presence of sugar, which, according to the singular discovery of the German chemist Klauer, prevents the decomposition of the carbonate of the protoxide by preventing the protoxide from passing into the state of sesquioxide. The same statement applies even more forcibly to the solid form of the same combination, the compound iron pills, or Griffith's pills.

Previous to the announcement of Klauer's discovery, Dr. Clark, of Aberdeen, had proposed to preserve the precipitated carbonate from passing into sesquioxide by avoiding any drying of it, and making it at once, after merely squeezing it, into an electuary with sugar and aromatics. And Dr. Christison had also previously observed, that the iron of this electuary had not lost its carbonic acid even when it became quite dry.

In the first English edition of the *Edinburgh Pharmacopœia*, advantage was taken of Klauer's discovery, and a saccharine carbonate of iron introduced. This saccharine carbonate is found to be a mixture of the carbonate, of the protoxide, and the sesquioxide. A pill of the saccharine carbonate was introduced at the same time. Many practitioners have of late adopted the use of the carbonate of iron made extemporaneously at the moment of being taken. The formulæ for this purpose contain some soluble salt of iron, with an alkaline carbonate, as the solution of the sulphate with the carbonate of soda. From 8 grains of sulphate of iron, and 10 grains of carbonate of soda in solution, an effervescing draught is obtained, containing 10 grains of carbonate of iron. The tincture of the muriate is also used in the same way with an alkaline carbonate. Besides these preparations, the sulphate and the black oxide contain iron in the state of protoxide, combined in the latter with the sesquioxide. Or the *London Pharmacopœia* contains three preparations in which the iron is in the state of protoxide—namely, the mistura ferri composita, the pilulæ ferricompositæ, and the sulphate of iron; while the *Edinburgh Pharmacopœia* contains the same, with the exception of the pilulæ ferri compositæ, and has besides the saccharine carbonate, the pills of the saccharine carbonate, and the black oxide, now made by precipitation after the formula of Wöhler.

More recently it has been found that sugar has also the effect of preserving the protiodide of iron from passing into the periodide. And this discovery has been taken advantage of in the new preparation of the *Edinburgh Pharmacopœia*, the ferri iodidi syrupus.

The most important new officinal preparation in which the iron is in the state of sesquioxide, is the hydrated sesquioxide, termed, rather unhappily we think, by the Edinburgh College, ferrugo. This is the substance re-

commended as an antidote to arsenic, and it will most probably be found to supersede the common rust and the sesquioxide formed from the precipitated carbonate.

Besides these officinal preparations, many others have been recommended of late, and some have come into use.

The following table includes those more worthy of notice :—

	Dose.
Ferri bromidum.....	gr. iii. to gr. viii.
Pilulæ ferri bromidi	gr. i. in each.
Ferri citras.....	gr. v. to gr. viii.
Ferri ammonio-citras....	gr. v. to gr. viii.
Ferri et quinæ citras	gr. iii. to gr. vi.
Aqua chalybeata (citrate of iron in water charged with carbonic acid and flavored with aromatics)	ʒii.
Ferri potassio-citras	gr. v. to gr. viii.
Liquor ferri potassio-citratis.	
Ferri tinctura aurantiaca (iron filings, Seville oranges, Madeira, &c.)	ʒi. to ʒss.
Ferri lactas.....	gr. vi. to gr. xii. in the day.
Ferri lactatis syrupus.	
Ferri lactatis trochisci.	
Ferri ammonio-tartras ..	gr. v. to gr. viii.
Ferri tannatis syrupus.	
Ferri confectio composita	ʒss.

The bromide of iron is deliquescent and very soluble. The dose is from three to eight grains. The pills are made with a *q. s.* of extract of liquorice, each containing one grain of bromide. Their use is against glandular enlargements, hypertrophy of the uterus,* &c.

The citrate and ammonio-citrate of iron have been met with in the shops for some time. The citrate is permanent in air, sparingly soluble in water, very soluble in boiling water, and the solution reddens litmus-paper. The ammonio-citrate is deliquescent, soluble in cold water, neutral to test-paper. The citrate is made by saturating a hot solution of citric acid with moist hydrated sesquioxide of iron; and the ammonio-citrate is made by adding enough of aqua ammonia to the same solution to render it neutral.

The citrate of iron and quinine is made by mixing four parts of citrate of iron with one part of citrate of quinine. The citrate of quinine is made by dissolving pure quinine in a solution of citric acid.

The ammonio-citrate, as soluble, is preferable to the citrate. The dose of either is from five to eight grains. The ammonio-citrate should be given in solution. The dose of the citrate of iron and quinine from three to six grains. The form of pill answers best for this medicine. The uses of these preparations are much the same as those of the tartrate.

The aqua chalybeata, made by Bewley and Evans of Dublin, contains 13 grains of citrate of iron in 6 oz. The dose is 2 oz. two or three times a-day.

The tinctura ferri aurantiaca is contained in the *Wirtemberg Pharmacopœia*. It is an agreeable preparation, the dose being from one drachm to half an ounce.†

The ferri-potassio citras and its syrup are recommended by Dr. Todd, and the mode of preparing them may be seen in the *Lancet*, 10th September 1842, p. 822.

The lactate of iron contains the protoxide. It is met with in small acicular greenish prisms, or in powder of a pale green color. It contains 3 equivalents of water of crystallisation. It is sparingly soluble, and during solution passes into a higher state of oxidation. It is made by adding iron-filings to lactic acid. The syrup and lozenges are made on the common plan. The dose of lactate of iron is from 6 to 12 grains in 24 hours. Use in chlorotic diseases, atonic amenorrhœa,‡ &c.

The syrup of tannate of iron is made from citrate of iron by adding simple syrup, syrup of vinegar, and extract of galls. The iron is said to be in the state of protoxide.§

The ferri ammonio-tartras occurs in brilliant scales, semi-transparent, and of a reddish brown color. It is soluble in cold water. It consists of one equivalent of tartrate of protoxide of iron, one equivalent of tartrate of ammonia, and four of water. It is made by adding hydrated sesquioxide of iron to a solution of tartrate of ammonia. It is permanent in composition, and is given to the extent of from 5 to 8 grains, in powder, pill, or solution. It is recommended chiefly in derangements of the uterine organs.‖

The confectio ferri composita, made according to a formula given to Mr. Heathcote

* See Neligan, *Conspectus of the Pharmacopœias.*

† See *Medical Times*, 11th March, 1843. p. 386. *London and Edinburgh Journal of Med. Science*, January, 1843. Neligan, *Conspectus of the Pharmacopœias.*

‡ *Memoir* by MM. Gelis and Coute; also *Medico-Chirurgical Review*, October, 1840, p. 511; and Neligan, *Conspectus of the Pharmacopœias.*

§ See *Medical Times*, 11th March, 1843.

‖ See Procter, in *American Journal of Pharmacy*; also Neligan's *Mat. Med.*, p. 359.

of Gosport, contains clinkers, the scoriæ got from the blacksmith's shop. These appear from several accounts published of late years to have been long a popular remedy. Mr. Heathcote says that they are much used in Bath under this form.

Take of clinkers reduced to an impalpable powder, 8 oz.; carbonate of magnesia, ½ oz.; powdered ginger, 1 drachm; treacle, a sufficient quantity: make an electuary; ½ oz. for a dose.

POISONING BY ARSENIC — ADMINISTRATION OF IRON — RECOVERY.*

BY SAMUEL ARGENT, ESQ., SURGEON.

I WAS called to J. P——, the daughter of a little tradesman of this town, about five o'clock a.m., on the 30th August, and found her violently vomited and purged; the evacuations consisting of a watery fluid, intermixed with lumps of green mucus. She had pain in the stomach, heat in the mouth and throat, with thirst. I was informed that she had been in this state all night. As she had been for some time past in a low and melancholy way from some disappointment that she had met with, it was at once suspected that she had taken a corrosive poison, which she stoutly denied; till, after a diligent search, a paper was found, with "Arsenic—poison," written upon it, when she confessed having taken half an ounce of arsenic the preceding evening. I then lost no time in washing the stomach out with whiting and water, by means of the stomach-pump, it being at hand, and afterwards gave her two drachms of sub-carbonate of iron (having none of the hydrated peroxide by me), which was repeated at short intervals; after which she was desired to take three table-spoonfuls of the following mixture frequently:—sulphate of iron, one drachm; solution of potash, half a drachm; water, twelve ounces. In a short time the sickness gradually subsided, though she continued to vomit occasionally that day and the next. She had leeches applied to the epigastric region, which bled copiously, and afterwards mustard cataplasms, and had mucilaginous medicines. On the third day the sickness had left her, she took some food, and appeared quite convalescent and out of danger. It appears that she had taken the arsenic a short time after eating her supper—a very small portion of bread and cheese (her appetite had been bad for some time), and a quarter of pint of beer. Could the recovery be attributed to the iron acting as an antidote, or from the mucous coat of the stomach having been protected by the scanty supper which she had just before eaten? I inquired of the druggist of whom she bought the drug, when he had sold it to her, and he said a few days before.

Hinckley, Sept. 3rd, 1844.

* From the *Lancet*, Oct. 19, 1844.

PILLS OF EXTRACT OF ALOES.*

M. RÖTTSCHER found that the extract of aloes absorbed moisture from the atmosphere, which rendered it difficult to preserve it in the form of pills; this may be avoided by adding a fourth part of carbonate of magnesia.

POISONING BY OXALIC ACID.†

BY H. LETHEBY, M.D., LECTURER ON CHEMISTRY AT THE LONDON HOSPITAL SCHOOL.

AN unmarried female, named Rebecca ——, aged 22, of previously good health, had on Saturday, September 28th, a quarrel with her lover respecting another of his mistresses, and in a fit of jealousy, after he had left, she must have taken oxalic acid, and destroyed herself, for she was found dead in her room on the following morning. My friend Mr. Garrett was sent for, who made a *post-mortem* examination of the body, removing the stomach and its contents, although he had great difficulty in so doing, from the corroded and softened state of that organ. These he brought to me to examine. The stomach was very much blanched, excepting in two or three places, where there were black spots, as if blood had been effused and acted upon by the poison; here and there a blood-vessel might be seen ramifying with its contents similarly blackened. The tissue of the stomach was so softened and disorganised, that it could scarcely be handled without tearing; indeed, at the cardiac end it was reduced to a soft, pulpy, or gelatinous consistence, and had numerous perforations in consequence. The contents which had been saved in a glass, amounted to about six ounces in quantity; they had a very dark color, like porter, and contained very little solid matter. They were strongly acid, and on being tested, were found to contain about three drachms of oxalic acid.

* *Forceps.*

† *Lancet*, Oct. 19, 1844.

Remarks.—It has been doubted by some authorities whether oxalic acid has any corrosive action on the stomach. Dr. Christison, I think, only mentions one case in which he found the stomach perforated after its exhibition, and Mr. Taylor remarks, that in his experiments on animals, and from some few observations on the human subject, he has found nothing to bear out the view, that perforation is a common effect of the action of this poison. This case, however, is sufficient to show that softening and perforation may take place, and in a medico-legal inquiry, it is proper and important to bear the fact in mind.

12, Tredegar-square, Oct. 7, 1844.

ON THE ABSORPTION OF CORROSIVE SUBLIMATE IN CASES OF POISONING.*

BY DR. R. M. GLOVER, LECTURER ON MEDICAL JURISPRUDENCE, NEWCASTLE-UPON-TYNE.

In a paper on poisoning by corrosive sublimate, published by Mr. Taylor, in the number of "Guy's Hospital Reports" for April last, are the following words:—"I have not been able to meet with any satisfactory instance where, in a case of poisoning by corrosive sublimate, mercury has been detected in the blood, secretions, or soft organs of the body. This statement is repeated in his work on medical jurisprudence, recently published. In his paper, and in this book, he refers to an experiment of mine, performed in 1840, but first published in a paper on bromine and its compounds, in No. 153 of *Craigie's Journal*. In this experiment I succeeded, I think, in finding mercury in the blood of a dog, to which I gave half an ounce of corrosive sublimate, and then secured the gullet by a ligature. But in the account that I gave of this experiment, which account Mr. Taylor would appear to have read, I referred to the researches of Orfila, published in the *Journal de Chimie Médicale* for July, 1842, and which researches, completely, and beyond the shadow of a doubt, establish the absorption of corrosive sublimate, and the detection of it in the "soft organs and secretions." Moreover, in the preceding part of my essay on bromine, published in 152 of *Craigie's Journal*, I give a reason for the absorption of corrosive sublimate, viz., the solubility of its compound with albumen in solutions of electro-positive chlorides. In *Cormack's Journal* for September, 1842, there is an abstract, by me, of the important researches of Orfila on the absorption of certain mineral and vegetable acids and metallic salts, in which due attention is paid to this important discovery of the absorption of corrosive sublimate. At the time, I remember being surprised at the absence of the information on this subject displayed in some of our most pretending journals; I say surprised, for Orfila is a great name. Had they been the most important researches ever given to the world from a man hitherto unknown to fame, I should not at all have been astonished. But how Mr. Taylor came first to misrepresent the circumstances attending my experiment, and secondly, to overlook the results of Orfila, although referred to by me in the account which I gave of this experiment, and given more fully by me in a British journal; nay, again fully related by Orfila in his work on Toxicology, published last year—how this happened I cannot understand. In Mr. Taylor's book, p. 176, he says:—"Corrosive sublimate is considered to be one of those poisons which are absorbed into the circulation; but chemists have in vain endeavoured to detect mercury in the blood secretions and soft organs of animals poisoned with it." Mr. Taylor says:—"Dr. Glover thought that the tests which he employed, indicated the presence of mercury; but as the metal was not procured, it is left uncertain whether mercury was really present in the blood or not." Now I expressly state that *I did obtain* "very faint evidence of the presence of mercury' by a reduction test; and the indications afforded by the other tests which I employed were such, that there can be no doubt, in my own opinion, of the existence of mercury in the blood which I examined. A brick-red precipitate, from carbonate of potass added to a solution formed by digesting nitric acid on the blood, and this precipitate redissolved in excess of the acid liquor, could indicate nothing but mercury; for, as Mr. Taylor is doubtless aware, Berzelius informs us that the iron of the blood could not so be made manifest. The experiment to which I have referred is still of some little consequence, notwithstanding the researches of Orfila, as this experimentalist failed to obtain decided evidence of the presence of mercury in the blood of animals poisoned by corrosive sublimate, although he detected it in the liver and the urine. I shall quote one of his experiments:—

"Five minutes after having poisoned a dog with eight grammes (the gramme is nearly 15½ grains Troy) of corrosive sublimate, dissolved in 180 grammes of water, I bled it, and treated 288 grammes of the blood with sulphuric acid, as in the sixth experiment. An

* *Lancet.*

hour after, I again extracted from the jugular vein 90 grammes of blood, and killed the animal; these two quantities of blood, submitted separately to the action of concentrated sulphuric acid (as has been stated in the sixth experiment), gave me, as a final result, two liquids, which I left for a long time in contact with several plates of copper; these latter were slightly tarnished, as if they had been plunged for a long time in a mercurial fluid; when rubbed they acquired a silvery lustre; nevertheless, when I submitted them to the action of the heat, in two glass tubes drawn out, I obtained a white vapour, excessively slight, in the midst of which it was impossible for me to perceive *well characterised* globules of mercury. The liver of this animal, carbonised with sulphuric acid, and treated by the same process as the blood, gave me, on the contrary, a very great number of little globules of mercury."

I hope Mr. Taylor will not suppose me animated by any but friendly feelings in making this correction. His work is in general a very excellent one; and, indeed, the best text-book on the subject of which it treats, that we possess, the very elegant work of Professor Traill being so brief.

Northumberland-street,
Newcastle-on-Tyne, Aug. 24.

THE TREATMENT OF ACUTE RHEUMATISM BY CINCHONA BARK.*

From a resemblance supposed to exist between acute rheumatism and certain periodic diseases curable by cinchona, this remedy has long been considered as applicable to the treatment of the former. Thus Fothergill remarked, "that those who are subject to intermittent are frequently liable to rheumatism;" and Morton says, that rheumatism is, as it were, an ague set astray; the poison lies latent in the system, and is irregularly developed. "Under the bark, this lurking character is detected, the disease drops its mask, and becomes readily cured." Dr. Haygarth was the first, however, to bring the subject prominently forward in his *Clinical History of Rheumatism*, an early specimen of the numerical method, for which so much credit has since been awarded to Louis. From this work, we learn that its author treated and cured with rapidity and ease 111 out of 121 cases of rheumatism by the use of cinchona bark. The late Professor Davis, with his characteristic ability, introduced the subject to the attention of the profession in a former volume of *The Lancet* (vol. i., 1840-41). Induced by this communication, Dr. Popham, of Cork, has tried the remedy, and he publishes the results in the last number of the *Dublin Journal*. He seeks to establish some principle as a guide in the administration of this agent. This communication is a valuable one, and we give at length the conclusions at which the author has arrived:—

"That it is important to procure due evacuations previously to the exhibition of the bark, except the patient be greatly deteriorated by constitutional debility, or the protraction of disease.

"That it is more *quickly* successful when the disease is *early* combatted by depleting measures, than when inefficiently managed at the onset, and allowed to take root in the system.

"Hence, that it is more like to extinguish the disease and prevent chronic infirmity in the sequel of *first* attacks being uncomplicated, then when a habit has been formed by reason of repeated relapses.

"That the periodicity of the symptoms either peculiar to the attack, or produced by treatment, and the duration and apyrexia of the intervals, afford strong presumptive arguments for the use of bark.

"That bark is especially called for in cases where there is complete atony of the cutaneous vessels, so that the skin is unceasingly pouring out acid colliquative sweats, giving it a dull and parboiled appearance, at the same time that the pains are abated, and the pulse small and indicating debility.

"That to produce its effects, quantity is not by any means as essential as in intermittent, and that large quantities, especially of the sulphate of quinine, derange the stomach in many cases, and bring back the fever.

"That it is judicious to administer it at the periods of remission, and stop it at the return of the exacerbations.

"That it is injurious when important visceral disease co-exists, and is especially contra-indicated in cerebral or the acute stage of cardiac complications.

"Lastly, that in the synovial variety, it is inferior to other modes of treatment, but in persons of a rheumatic diathesis, when, from the long continuance of the disease, the strength has suffered, and disfigurations of the joints have occurred without serious destruction, a course of bark, combined with sulphur, &c., often prevents the recurrence of subacute attacks, and promotes the absorption of the effused synovia.

"In conclusion, it must be observed, that

* *Lancet.*

the cases in which this medicine is given should be kept in strict surveillance, and it should of course be suspended if it cause gastric symptoms. With this caution—and it is not more than is required by other remedies—the physician will often be indebted to the preparation of bark for completing the cure of a disease, that if left to fix itself in the system, will weaken the energies and damp the happiness of his patients more than any other."

ON THE PROTECTIVE INFLUENCE OF VACCINATION.*

The general conclusions, drawn by Dr. Retzius, of Stockholm, from his observations of small-pox, and the effects of vaccination in Sweden, are these:—"The protection afforded by vaccination from the close of the second year of life against the contagion of the variolous poison, usually lasts unimpaired to the end of the thirteenth year or so; after this period it begins to lose its effect, and gradually becomes more and more uncertain on to the twentieth or twenty-first year of life. For the next four or five years, the disposition to the small pox seems almost to have recovered its original integrity; and this state of liability continues unimpaired up to the age of forty years or so. At about this epoch of life it begins to approach nearer and nearer to the limit of its existence—which it reaches, in the majority of cases, about the fiftieth year—the period when the general revolution of the body commences to take place."

The practical inference to be drawn from these remarks is the propriety of repeating vaccination in about thirteen or fourteen years after its first performance. This advice is in accordance with the observations of the most experienced practitioners; it would be well if it were more generally acted upon.

SEA-SICKNESS, A REMEDY IN CERTAIN CASES OF JAUNDICE.

BY H. PERCY, ESQ., WORTHING.

Emma Cox, aged twenty-eight, cook in a gentleman's family, of a full habit, had been suffering from jaundice between three and four months; previous to this attack had always enjoyed good health. When I first saw her the skin was deeply died, bowels obstinately constipated, with pain in the epigastric region, recurring at intervals, but not of a very severe character; the motions had not the least tinge of bile. After attending on her a considerable time without at all relieving her, I one day, when the sea was rough, recommended her sailing in a boat for three or four hours; she at once followed the advice, and, to use her own words, was horribly sick. I afterwards administered a dose of brisk aperient every four hours; within twenty-four hours she discharged, by stool, several small gall-stones and a large quantity of inspissated bile. The complexion rapidly became clear, and she soon got perfectly well, an occasional aperient being the only medicine used. I have not as yet had an opportunity of trying this remedy a second time, but where there is only mechanical obstruction to the passage of the bile, I think the relaxing effects of sea-sickness must tend to accelerate the stone through the duct.

In the above case the patient was cured at once by it, and were it not so immediately beneficial (as will most probably generally be the case) it might be persevered in, with intervals of a few days, with a reasonable prospect of success.

August 6, 1844.

DIABETES TREATED BY ALKALIES.

MM. Miale and Contour narrated a case of diabetes mellitus cured by the use of alkalies and sudorifics. The patient, a man forty-three, had been laboring under diabetes for eighteen months, and was in the following state:—Extreme prostration and emaciation, great weakness, appetite good, digestion easy, thirst intense, dryness of the mouth, although he drank five or six quarts a day. His urine was abundant, and the quantity was always in relation to the fluid he introduced into the economy. It was acid and nearly colorless; density 10·35; it contained a little more than nine drachms of sugar for each quart. After giving, without any result, the chloride of sodium during fifteen days, the internal administration of alkalies was commenced, as also the use of flannel, of vapor baths, and of a highly-animalised diet. One drachm of bicarbonate of soda and eighteen grains of calcined magnesia were given daily during eight days. The dose of bicarbonate was then progressively raised to one drachm and a half, to two and a half, and, lastly, to three. The doses of the magnesia remained the same. This treatment lasted a month, and was followed by complete success. The quantity of sugar contained in the urine gradually decreased, and when the fluids of the economy had re-

* *Medico-Chirurgical Review.*

covered their alkaline properties, it entirely disappeared. At that time the patient was cured, and eating every day a pound of bread along with a pint of milk. He still, however, continued the use of the alkalies, and it was impossible to say whether the symptoms might not return were their administration suspended.

IV. REVIEWS AND NOTICES OF BOOKS, &c.

LECTURES TO FARMERS ON AGRICULTURAL CHEMISTRY. By Alex. Petzholdt.

At a period when the application of chemistry to agriculture is attracting great attention on the part of scientific and practical men, the appearance of a work recapitulating like the one before us all the scientific discoveries and views connected with the subject, cannot but be hailed with satisfaction.

It is scarcely necessary, we hope, to remind the agricultural readers of this journal of the imperative necessity that exists for their procuring and carefully studying every work on the subject. These lectures, especially dedicated to practical agriculturists, must prove useful in the highest degree to them.

We conclude by giving as an extract, the Appendix to this work.

"It cannot be too frequently or too urgently impressed upon the agriculturist, that the application of chemistry to the improvement of his art is far too recent to have brought forth all its fruits. Chemistry itself, in its application to organic nature—in its investigations into the composition and functions of plants and animals, is in a state of progress, not of perfection. There must still be, therefore, conflicting opinions; and facts, announced as discoveries, must be expected to be refuted, and replaced by better, as the science advances. Nevertheless, agriculture cannot be perfected without chemistry. How is it possible, whilst the composition of the soil, of the plants growing upon it, and of the manures supplied for their nourishment, shall all continue unknown? Laborers are wanted in this field of science! Farmers themselves must be able to find out what are the materials existing in their soil. The chemist must ascertain what substances enter into the composition of every species of plant, and are therefore indispensable to their growth. Commercial men will soon discover the sources whence the necessary manures may be obtained in the cheapest and best form. A few words upon guano, in addition to the text, will illustrate these remarks. The analyses there given are of South American guano; of that brought from Africa, the following have been published, by Mr. Francis, Dr. Ure, and Mr. R. Phillips.

"In 100 parts, one specimen contained:—

Ammonia	9·70
Water	27·13
Phosphates of lime, magnesia, &c.	22·32
Alkaline salts, chiefly potass, with sulphuric, phosphoric, and hydrochloric acids	7·08
Combustible organic matters—urie acid and extractive	32·89
Sand	·81
	100·00

"A second specimen:—

Ammonia, chiefly combined with phosphoric acid, some carbonate	9·5
Water	28·5
Earthy phosphates	18·5
Fixed alkaline salts, chiefly potass	6·0
Combustible organic matter—three parts urie acid	37·0
Sand	·5
	100·0

"A third:—

Ammoniacal salts, containing 7⅕ of ammonia, and organic animal matter	46·0
Phosphate of lime, &c.	19·8
Fixed alkaline salts	4·2
Sand	4·0
Water	26·0
	100·0

"It is a question of no small importance to the agriculturists, to which of these constituents of guano it owes its fertilising properties. The ammonia is generally considered to be the most valuable ingredient; but the recent investigations of the German chemists seem to indicate that the presence of the earthy phosphates gives guano its chief value. Experiments, to determine this point, are needed. The farmer must remember that, in purchasing guano, he receives with every ton from five to six *cwt.* of water, from one and a half to two *cwt.* of ammonia, and about double the latter amount of the earthy

phosphates. According to the principles of this work, the value of guano as a manure would be increased by mixing it with wood ashes, as the latter would supply the necessary fixed alkaline salts. So far as the ammonia is valuable, the farmer must remember that *quick lime*, mixed with the guano, would drive the ammonia off, whilst *gypsum*, *soot*, sulphuric acid, &c. would serve to render it fixed.

"It is a question of relative cost, whether the farmer should purchase guano, or endeavor to supply its place by artificial mixtures. The following is a receipt for artificial guano:—

Bone dust	3 cwt.
Sulphate of ammonia.	1 ,,
Common salt.....	1 ,,
Sulphate of soda	10 lbs.
Pearlash	10 ,, Mix.

"He cannot be an economical farmer who would purchase guano while he allows stable urine to run to waste. In addition to the method recommended in the text, as best adapted to fix the ammonia of stables, it may be mentioned, that another excellent and cheap method is to mix one pound of sulphuric acid with about twenty pounds of water, and to sprinkle this dilute acid upon saw-dust, which for this purpose may be spread lightly in suitable parts of the stable. This method is said to have been found highly beneficial to the health of cattle, and to dogs in kennel, by fixing the floating ammonia.

"In order to escape from the frauds practised in the adulteration of guano, the farmer should possess the means of testing it; at least, so as to approximate to a knowledge of its composition. For this purpose it will be sufficient to perform three simple experiments.

"First. Treat 100 grains with lukewarm water, and, after shaking it for some time, filter the solution through paper; about 68 per cent. should be soluble.

"Secondly. Dissolve 100 grains in strong hydrochloric acid, and, in the same way, about 94 per cent. should dissolve.

"Thirdly. Place 100 grains in a stoppered retort, and adapt the retort to a receiver, in which is contained dilute hydrochloric acid, about ¼ of an ounce of the acid to 4 ounces of water. Into the retort throw 100 grains of slacked lime, and about an ounce of water; apply a gentle heat, until all the water has passed over. Evaporate the contents of the receiver to dryness, and weigh the sal ammoniac which remains. One-third of the amount very nearly expresses the amount of ammonia present in the guano. Thus, 100 grains of guano should yield about 27 grains of sal ammoniac.

This does not furnish an absolutely exact measure of the value of the guano. There may be certain nitrogenous ingredients which escape decomposition, but these are so insignificant in amount, that for practical purposes the approximation is sufficient.

In a recently-published paper emanating from the Giessen school, it is stated that, for most purposes, a chemical examination of the soil is best accomplished by carefully collecting all the plants growing upon it, both those cultivated and the weeds, reducing them to ashes, and subjecting these ashes to chemical analysis. In this manner all the soluble constituents of the soil may be known, and the presence or absence of alkalies, alkaline earths, and phosphates may be ascertained.

When we know the composition of the ashes of the weeds and cultivated plants, we know the soluble constituents of the soil, and we can determine for what crop it is most suitable.

In order to enable this inquiry to be pursued as extensively as the interests of agriculture require, Drs. Will and Fresenius have devised and published a method for the examination of the ashes of plants, which is as follows:—

PREPARATION OF THE ASHES.

Plants in a normal and healthy condition should be selected (unless the design be to study diseases and their causes). All foreign matter, such as dirt, dust, &c., should be carefully removed; but the plants should not be washed, or the soluble salts will be extracted. Plants exposed to moist weather, or in a withered state, should also be rejected for the same reason.

Woods, herbs, and roots, after being perfectly dried, may be burned upon a clean iron plate; leaves, fruits, and seeds will be best burned in a Hessian crucible, using as fuel charcoal, amidst which the crucible should be placed somewhat obliquely. Sometimes the ashes are left perfectly white; but some seeds require a higher temperature than others to rid the ashes of charcoal, which is mixed with the phosphates: care must, however, be taken not to fuse the alkaline salts, or they will prevent the perfect combustion of the charcoal. Those ashes will be burnt the whitest which are not shaken or stirred together. The ashes should afterwards, if necessary, be heated to low redness in an open platinum crucible, over a spirit-lamp, with constant stirring; then, whilst still warm, rubbed to a fine powder, and transferred to a well-stopped bottle.

A qualitative analysis should first be made

in order to determine to which of the three following groups the ashes belong.

A. *Ashes rich in alkaline and earthy carbonates.*—Woods, lichens, &c., containing salts with organic acids, yield ashes of this kind.

B. *Ashes abounding in phosphates of alkalies and earths;* as the ashes of seeds, grain, &c.

C. *Ashes rich in silica.*—The grasses and straw of cereals belong to this group.

PRELIMINARY QUALITATIVE EXAMINATION OF ASHES.

A portion of the ashes being treated with concentrated hydrochloric acid, a considerable effervescence denotes them to belong to the first group.

If the ashes abound in silica, this will be left undissolved by hydrochloric acid.

In other cases concentrated hydrochloric acid dissolves the ashes of plants completely. After the separation of the silica, the acid solution is treated with acetate of ammonia, or it may be neutralised by means of caustic ammonia, free acetic acid being afterwards added. In most cases a yellowish-white gelatinous precipitate is formed, consisting of phosphate of peroxide of iron. This precipitate must be collected upon a filter, and ammonia added in excess to the clear solution, by which means a fresh precipitate will be obtained. If a red precipitate be formed, it is peroxide of iron. The solution should now be allowed to stand for some time, the air being excluded; if no precipitation takes place the ashes contain no phosphate besides that previously separated; but if there be a white precipitate, it consists of phosphate of lime and phosphate of magnesia, more phosphoric acid being present than is combined with peroxide of iron. This completes the qualitative examination, unless the operator choose to test for fluorine, oxide of manganese, iodine, bromine, or any other substance, the presence of which may be suspected. Separate portions of acid must be used for these purposes, as also for carbonic acid, and alkalies, in ashes belonging to the third group. The other constituents may be determined in one quantity of ashes; the silica has only to be separated once.

QUANTITATIVE EXAMINATION OF ASHES.

A. *Determination of the Quantity of Ashes in Plants.*—It is often highly desirable to ascertain the entire quantity of inorganic constituents of plants. A quantity of solid matter is annually removed from the soil in the crop, and it is necessary to repair this loss by means of manures. The weight of the crop, taken from a given surface, should therefore be well known; and rational agriculturists acquire this information with sufficient accuracy for practical purposes.

The vegetable substance under examination should be dried over a water-bath until it no longer loses weight. The quantity most convenient to employ depends upon the proportion of its inorganic constituents. Herbs and seeds, being rich in these matters, from thirty to fifty grains will be sufficient, whilst ten times that amount must be taken of woods. The combustion succeeds best in a platinum crucible, at first covered and heated gently; afterwards remove the lid and apply a stronger heat to consume all the charcoal. Those ashes which do not effervesce with acids, as the ashes of seeds, may be treated with nitric acid and again ignited, when they will be speedily rendered quite white.

B. *Analysis of Ashes rich in Carbonates and Phosphates.*

1. *Determination of the Silica, Charcoal, and Sand.*—About sixty grains of the ashes, which have been found soluble in hydrochloric acid, are to be treated with concentrated acid in a matrass, held obliquely, so as to avoid any loss of fluid during the evolution of carbonic acid; a gentle heat is then applied, until it is evident that every thing is dissolved, excepting the carbonaceous and sandy particles. The whole is now carefully removed into a porcelain basin, evaporated to dryness over a water-bath, and then heated somewhat more strongly, as is usual in separating silica. The mass when cold is moistened with strong hydrochloric acid, digested for half an hour with a sufficient quantity of water, and boiled, after which the acid liquid is poured upon a stout filter which has been previously dried at 212° and weighed.

The silica will remain upon the filter, and if the ashes were not perfectly white and pure, some sand and charcoal also. The filter is washed and dried, and the substance carefully removed from it into a platinum crucible, without injury to the paper. This is easily effected if the matters be perfectly dry, the paper in most cases only retaining so much as to be slightly colored by the charcoal. The powder is now boiled for half an hour with pure potass-ley (free from silica), by which the whole of the silica will be gradually dissolved, leaving the sand and the charcoal unacted upon. The insoluble matter is again collected on the same filter, washed, and dried at 212° until it no longer loses weight. The increase upon the weight of the dried filter is estimated as charcoa and sand.

The filtered solution, after the addition of hydrochloric acid in excess, evaporation to

dryness, and treatment in the usual way, gives the amount of silica.

"The acid solution originally filtered from the silica, sand, and charcoal, after being well mixed, is divided into three, or more conveniently into four equal portions, one being reserved in case of misfortune with either of the other quantities. The division is best accomplished by means of an accurately graduated tube; the whole of the fluid is collected into the tube, the entire measure then representing the weight of ash experimented upon. The solution is now divided into three or four equal or known portions, the volume of each is noted, and they are distinguished by the letters *a*, *b*, *c*, and *d*.

"In (*a*) the proxide of iron, oxide of manganese and the alkaline earths are estimated.

"In (*b*) the alkalies.

"In (*c*) the phosphoric and sulphuric acids.

"2. *Estimation of the Peroxide of Iron and of Alkaline Earths.*—To the solution (*a*) ammonia is added until the precipitate which is thereby produced no longer entirely redissolves; acetate of ammonia is next added, and enough acetic acid to render the solution strongly acid. From the form and appearance of the precipitate it can easily be judged whether it still contains phosphate of lime; if this be the case, more acetic acid must be added. The yellowish-white precipitate which remains consists of phosphate of the peroxide of iron, $2\,Fe^2\,O^3 + 3\,PO^5$. Its separation from the fluid is assisted by gently heating; it is then well washed upon a filter with hot water, ignited and weighed.

"To the filtered solution, neutral oxalate of ammonia is added as long as a precipitate is formed, and the quantity of lime is determined in the usual manner. When it has been shown by the qualitative analysis, that besides phosphate of iron, the ash contains peroxide of iron or oxide of manganese (in which cases the presence of earthy phosphates is very rarely detected), the solution, previously to the separation of the lime, should be super-saturated with ammonia, and precipitated by means of sulphuret of ammonium; the two oxides being afterwards separated according to the known methods.

"If the ashes under examination contained earthy phosphates, the solution, filtered from the oxalate of lime, will contain free acetic acid; if otherwise, there will be free ammonia: it is next somewhat concentrated, rendered ammoniacal, treated with a solution of phosphate of soda, and separated from the precipitate, which is estimated as phosphate of magnesia.

"3. *Estimation of the Alkalies.*—The solution (*b*) is treated with water of barytes until it gives an alkaline reaction; it is then gently heated and filtered. By this means we get rid of all the sulphuric acid, phosphoric acid, and peroxide of iron, as well as the magnesia, and most of the lime. The precipitate is washed upon a filter as long as the liquid renders turbid a solution of nitrate of silver; the solution is next warmed, treated with caustic ammonia and carbonate of ammonia, and allowed to stand until the precipitate becomes heavy and granular. The whole is now filtered, and the solid matter is washed, after which the solution is evaporated to dryness, and the residue heated to redness in a platinum crucible, in order to expel the ammoniacal salts. What remains consists of the chloride of potassium or sodium, or more generally of a mixture of the two. The weight being noted, a little water is added, which mostly leaves undissolved a trace of magnesia; this is collected on a filter, its quantity subtracted from that of the supposed alkaline chlorides, and added to that of the magnesia as previously ascertained. The quantity of potass is determined by means of chloride of platinum in the usual way; and that of the soda is calculated from that of the chloride of sodium, indicated by deducting the weight of the chloride of potassium from that of the mixed alkaline chlorides.

"4. *Estimation of the Sulphuric and Phosphoric Acids.*—From the acidulous solution (*c*), the sulphuric acid is first separated by means of chloride of barium. The filtered liquid is nearly neutralised with ammonia, acetate of ammonia is added, and then a solution of perchloride of iron, until the liquid begins to turn red, owing to the formation of acetate of iron. Care must here be taken that sufficient acetate of ammonia be added to convert the whole of the chlorine of the perchloride into sal-ammoniac. The solution is now boiled until it becomes colorless, all the iron being then precipitated. The precipitate, after being washed with hot water, consists of phosphate of iron and a quantity of basic acetate of iron. It is dried, ignited in a platinum crucible, treated with a few drops of nitric acid, re-ignited and weighed. It is next digested with concentrated hydrochloric acid, which speedily dissolves it. The solution is diluted with hot water mixed with tartaric acid, and ammonia is added until the yellowish-white precipitate which is at first formed, disappears. A clear solution, but of a dingy green color, is thus obtained, from which the iron is precipitated by means of sulphuret of ammonium. The precipitate and supernatant fluid are digested together in the water-bath until the latter loses its green tinge, and assumes a clear

yellow color, resembling that of the sulphuret of ammonium. It is now rapidly filtered, access of air being excluded, and the precipitate is then washed with hot water containing a little sulphuret of ammonium, until a drop of the filtered liquid, dried upon a platinum spatula and ignited, no longer manifests an acid re-action. The sulphuret of iron as dissolved from the filter by means of hot and dilute hydrochloric acid, the solution is boiled, treated with a few drops of nitric acid to peroxidise the iron, and ammonia is then added in excess. The precipitate is pure peroxide of iron, the weight of which, deducted from that of the basic phosphate, gives the quantity of phosphoric acid.

"It is essential that the perchloride of iron used in this experiment should be quite free from sulphuric acid.

"5. *Estimation of the Chlorine.*—A fresh portion of ashes (about fifteen grains) is weighed out, exhausted by means of hot water, slightly acidulated with nitric acid, and the solution precipitated with nitrate of silver. If the ashes contain appreciable quantities of iodine or bromine, these bodies will be found in the precipitated silver-salt; for their quantitative estimation, however, a larger portion of ash must be employed.

"6. *Estimation of the Carbonic Acid.*—The quantity of carbonic acid is represented by the loss sustained on treating a known weight of ashes with an acid; and we have elsewhere described the most convenient method and apparatus for the experiment.

"C. *Analysis of Ashes abounding in Silica.*—These ashes are only partially soluble in acids; their alkalies must therefore be determined in a separate portion.

"The chlorine and carbonic acid are determined in the same manner as with ashes soluble in acids; but it must be remembered that the alkaline chlorides undergo a partial decomposition, when ignited with silica and carbon.

"1.—*Estimation of the Silica, &c.*—A concentrated solution of pure potass or soda, is poured upon about 60 grains of the ashes, and evaporated to dryness in a platinum or silver dish. The silica compounds are thus dissolved:—The heat should be so great as to diffuse the mass: dilute hydrochloric acid is then poured on the dry mass, and evaporated, and the silica determined in the manner already described. The acid solution, filtered from the insoluble matter, is divided into two parts; one is employed for the determination of the sulphuric acid and phosphoric acid, the other for that of peroxide of iron and of the alkaline earths, by the methods detailed above.

"2. *Estimation of the Alkalies.*—A second portion, say 50 grains, of the ashes is ignited in a platinum or silver crucible, with four times its weight of hydrate of barytes; the acid solution which remains after separating the silica, is precipitated successively with barytes water and carbonate of ammonia, the alkalies being then obtained in the state of chlorides."

SELECTA È PRÆSCRIPTIS. Selections from Physicians' Prescriptions; containing lists of the Terms, Phrases, Contractions, and Abbreviations used in Prescriptions, with Explanatory Notes; the Grammatical Construction of Prescriptions, Rules for the pronunciation of Pharmaceutical Terms; and a Series of Abbreviated Prescriptions illustrating the use of the preceding terms. To which is added a Key, containing the prescriptions in an Unabgreviated form, with a literal translation. Intended for the use of Medical and Pharmaceutical Students. Ninth Edition, much improved. London: S. Highley, Fleet-street. 1844.

This very useful work having long been known to the profession we need say but little respecting it. Students of medicine and pharmacy will find it a most valuable preceptor, guiding them to the most correct method of prescribing, and also aiding them to decipher the prescriptions of practitioners.

In order to give such of our junior readers as may not have seen the former editions, a full idea of the improvements in this edition, we give the preface entire.

"This little work has been before the public for about eighteen years, during which time eight large editions of it have been sold; and the publisher states that the ninth edition is much inquired after. These facts have satisfied the author that the work has proved useful.

"It is hoped that the present edition will be found greatly superior to the preceding ones, from which it differs in the following, amongst other, particulars:—

"1. The List of Terms, Phrases, &c., has been considerably enlarged, and numerous additional notes appended. The distinctive meanings of the various synonymes have been carefully pointed out; and the Latin words or phrases connected with the corresponding English ones, by the same figure being fixed to each.

"2. The Chapter on Nomenclature has been almost entirely re-written, and, it is believed, greatly improved. Moreover, a list of classical and barbarous names has been added.

"3. To the Chapter on Abbreviations and Contractions there has been added a tabular view of such abbreviated names of medicines as are applicable to two or more substances, and the use of which, therefore, by the prescriber, may lead to serious mistakes in dispensing.

"4. The Chapter on the Pronunciation of Pharmaceutical Terms is entirely new. Imperfect and incomplete as it necessarily is, the Author notwithstanding trusts that it will not be without its usefulness.

"5. A tolerably copious Table of Contents has been given; that contained in preceding editions being much too concise.

"6. An Index of some of the principal subjects, terms, and explanatory notes has also been added."

FAMILIAR LETTERS ON CHEMISTRY. By JUSTUS LIEBIG, M.D., PH.D., F.R.S. Edited by JOHN GARDNER, M.D.

(*Extract continued from our last.*)

"Alcohol, one of the products of the fermentation of saccharine vegetable juices, is altogether incapable of undergoing the process of decay; when exposed to the air, whether in its pure state or mixed with water, it evaporates without combining with oxygen. Alcohol is readily inflammable at a higher temperature, and in burning is resolved into carbonic acid and water. It is obvious that its elements have a powerful affinity for oxygen; the high temperature is, however, a necessary condition of the manifestation of this affinity. Hydrogen gas and many other inflammable substances, are, in this respect, precisely similar to alcohol, their affinity for oxygen manifests itself only at certain high temperatures.

"In the process of decay it has been likewise observed that a substance undergoing this state of elementary transposition exercises a remarkable influence upon the particles of an adjacent substance, which, *per se*, would not be capable of passing into the same state of change, decay, or transposition.

"Many substances, when in contact with another in a state of decay, manifest, at common temperatures, an affinity for oxygen; that is, they enter into combination with this element, at this low temperature, whilst under other circumstances such a combination can only be effected by a far higher degree of heat.

"The active absorption of oxygen, the combustion of the decaying substance, is transmitted to the particles of other substances in contact with it; they assume its characteristic state of activity; they, like it, combine with oxygen, as if undergoing a real combustion; but how this is effected does not appear to admit any further explanation. Contact with a substance, itself undergoing the process of decay, is the chief condition of decay for all organic substances which do not possess the power of combining with oxygen at common temperatures. In consequence of the ensuing combination of its elements with oxygen, the temperature of the decaying substance rises above that of the surrounding medium; but great as the influence is which heat exercises in accelerating the process, it is not in this, as in other chemical processes, the cause of the manifestation of the affinity for oxygen.

"If, in a vessel filled with common atmospheric air, to which a certain amount of hydrogen gas has been added, a linen bag be suspended, filled with wet sawdust, vegetable mould, &c., the process of decay will continue just as it would if they were exposed to the open air. They will convert the surrounding oxygen into carbonic acid. But what is very remarkable in this case, the hydrogen also participates in the process—it undergoes decay; that is, from being in contact with decaying substances, it acquires the power of combining with oxygen at the common temperature. If there be a sufficient amount of oxygen present, all the hydrogen gas is converted into water.

"Other inflammable gases, both simple and compound, are affected under these circumstances in exactly the same manner as hydrogen. The vapor of alcohol, for example, when in a vessel containing wood or other substances in a state of decay, absorbs oxygen from the atmosphere, and becomes transformed into aldehyde, and subsequently into acetic acid, which, upon assuming a fluid state, is withdrawn from the further influence of the oxygen.

"It is upon this power of substances undergoing decay, to increase the attraction of all organic substances for oxygen, and especially the affinity of alcohol for this element, that a speedy process for acidifying alcohol is based, which is termed the 'quick vinegar process.'

"The transformation of fermented liquors into vinegar formerly required weeks, and even months, to accomplish, in consequence of the imperfect access of the air: we can now convert alcohol into vinegar in less than twenty-four hours; and this is effected mainly by making brandy diluted with water, or any other weak spirituous liquor, trickle slowly through casks filled with wood shavings, and at the same time causing a slight stream of air to circulate through

these shavings. This method exposes to the air a surface of alcohol capable of absorbing oxygen by many thousand times more extensive than the old method; and consequently the time which alcohol, under ordinary circumstances, requires for its acidification, is abridged in the same proportion. At the commencement of this process it is usual to add to the dilute spirit a small quantity of some substance containing matter capable of undergoing the process of decay, such as beer-wort, honey, vinegar, &c.; but, after lapse of a very short time, the surface of the wood-shavings passes into a state of oxidation, and from that moment effects the transformation of the spirit into vinegar without the further co-operation of extraneous decaying matter.

"The application of our knowledge respecting the phenomena attendant upon decay, to the manufacture of beer and wine, is easy and obvious. The property of beer and wine to be converted into vinegar when in contact with the air, depends invariably upon the presence of foreign matters which transmit their own inherent aptitude to absorb oxygen to the particles of alcohol in contact with them. By removing completely all such substances from wine and beer, these lose altogether the property of acidifying, or of being converted into vinegar.

"In the juice of grapes, poor in sugar, there remains, after the completion of the process of fermentation—that is, after the resolution of the sugar into carbonic acid and alcohol—a considerable amount of nitrogenous constituents, retaining the same properties which they possessed in the juice previous to fermentation. This does not happen with the juice of the grapes of southern climates. These grapes are rich in sugar, and a considerable amount of this substance remains undecomposed after all nitrogenous matters have completely separated in an insoluble state, as yeast. Such wines alter very little when exposed to the air: the red wines of this kind, however, acidify because their coloring matter is of ready mutability, and performs, when in contact with the air, the part of the nitrogenous constituents.

"The nitrogenous constituents of the grape-juice which remain in wine, after fermentation, are those ferments, or exciters of fermentation in the sugar, of which I have already spoken in previous letters. After the complete transformation of the sugar, they exercise upon the alcohol exactly the same effect as the decaying wood—they are the exciting causes of the ensuing process of acidification.

"The affinity of these substances for oxygen is very powerful; during the short space of time necessary to transfer wine from one cask into another, they absorb oxygen from the air, and induce a state of acidity in the wine, which goes on irresistibly if it be not checked by artificial means. It is well known that this check is practically effected by sulphuration. A piece of sulphur is burned in the cask destined to receive the wine, the contained air is thus deprived of its oxygen, and an amount of sulphurous acid is formed equal to the volume of the oxygen. This newly-formed sulphurous acid is rapidly absorbed by the moist internal surface of the cask. Sulphurous acid possesses a stronger affinity for oxygen than the exciters of acidification in the wine. The acid is gradually diffused from the internal surface of the cask through the wine, and withdraws from those substances, as well as from the wine itself, all the oxygen they have absorbed from the atmosphere, and thus reconverts the wine into the state in which it existed previously to being transferred into the new cask. The sulphurous acid in this process becomes converted into sulphuric acid, and exists as such in the wine.

"When the wine is stored up in casks to ripen, a constant, although very slow, diffusion of air takes place through the pores of the wood, or, what comes to the same thing, the wine is incessantly in contact with a minute amount of oxygen; by means of which, after the lapse of a certain time, the entire quantity of the exciters of acidification, that is, the nitrogenous substances present in the wine, oxidise and separate in the form of a sediment or dregs, termed under-yeast.

"The separation of yeast from wine or beer, during the fermentation of grape-juice or of wort, takes place in consequence of the absorption of oxygen, or, in other words, is a process of oxidation, occurring in the fermenting liquid. The nitrogenous constituent of barley is in its primary state insoluble in water, but in the process of malting, or whilst the grain is germinating, it becomes soluble in water, it assumes the same condition or nature which belongs to the nitrogenous constituent of grape-juice originally.

"Both these substances lose their solubility in wine, or in beer, by absorbing oxygen. According to analyses in which we may confide, made with regard to this point, wine-yeast and beer-yeast are far richer in oxygen than the nitrogenous substances from which they are derived.

"As long as any particles of sugar, in a state of fermentation, are present in the fluid together with these nitrogenous matters, the fluid itself supplies the oxygen

required for their transformation into yeast by the decomposition of a small amount of the sugar or of water. This oxidising process within the fluid itself, which cause the nitrogenous constituents to become insoluble, ceases with the disappearance of the sugar; but it is renewed if the fluid is reconverted into a fermenting state, by the addition of new portions of sugar, and it ensues also when the surface of the fluid is exposed to the free access of the atmosphere. In the latter case the separation of the nitrogenous constituents is effected by the atmospheric oxygen, and is thus a consequence of their decay or slow combustion.

"I have already stated that the presence of nitrogenous matters in alcohol causes the transformation of the alcohol into acetic acid when there is a sufficient supply of air; now it is owing to the inequalities in their relative affinities for oxygen, that during the maturation of wine in the storehouse, when the access of air is extremely limited, that the nitrogenous substances alone oxidise, and not the alcohol. In open vessels, under these circumstances, the wine would be converted into vinegar.

"The preceding remarks render it obvious that if we possessed any means of preventing the transformation of alcohol into acetic acid we should be able to preserve wine and beer for an unlimited period, and to bring these liquors into a state of perfect maturity; for, under such circumstances, all those substances which cause wine and beer to acidify would become insoluble by combining with oxygen, and separate from the liquid, and with their perfect removal the alcohol present would altogether lose the property of absorbing oxygen.

"Experimental art has discovered a means of accomplishing this purpose perfectly. It consists in maintaining the fluid at a low temperature when undergoing fermentation. The method, based upon this principle, and employed in Bavaria, is one which the most perfect theory could scarcely have surpassed in certainty and simplicity, and it seems impossible to devise one more in accordance with science.

"The transformation of alcohol into acetic acid by contact with a substance in a state of decay, occurs most rapidly at a temperature of 95° Fahrenheit. At lower temperatures the affinity of alcohol for oxygen decreases, and at from 46° to 50° Fahrenheit no combination with oxygen takes place under these circumstances, whilst the tendency of nitrogenous substances to absorb oxygen at this low temperature is scarcely diminished in any perceptible degree.

"It is, therefore, obvious, that if wort be fermented in wide, open, and shallow vessels, as is done in Bavaria, which afford free and unlimited access to the atmospheric oxygen, and this in a situation where the temperature does not exceed 46° to 50° Fahrenheit, a separation of the nitrogenous constituents, *i. e.*, the exciters of acidification, takes place simultaneously on the surface, and within the whole body of the liquid. The clearing of the beer is the sign by which it is known that these matters are separated. A more or less perfectly complete removal of these nitrogenous substances, however, according to this method of fermentation, depends upon the skill and experience of the brewer. It may be easily conceived, than an absolutely perfect separation of them is attained only in rare and extremely happy instances. Nevertheless, the beer obtained in this manner is invariably far superior in quality and stability to that brewed according to the common method.

"The exceedingly favorable influence which the adoption of this principle must exercise upon the manufacture of wine is indisputable. It is too evident to admit of a doubt that it will lead to the adoption of a more rational method than has hitherto been employed. The reason that it has not long since been in use, and that the growers of wine have not derived from it the great advantages it is calculated to afford, is obviously their imperfect knowledge respecting it; nay, I may say the total ignorance of the great majority of wine-growers and manufacturers upon this point.

"Wine prepared by this method will, of course, bear the same relation to the wine prepared in the ordinary way, that Bavarian beer bears to common beer, in the fabrication of which the same amount of malt and hops has been employed. In the shortest possible time the same quality, the same maturity, may be attained by the wine which, under ordinary circumstances, would result, only after long and protracted storing. If it be borne in mind that the period for the manufacture of wine is the end of October, just at the cool season which is peculiarly favorable to the fermentation of beer, and that no other conditions are necessary to the vinous fermentation than a cool cellar, and open, wide, shallow fermenting vessels, and further, that under all circumstances the danger of acidification is much less with wine than with beer, it is evident that the best success may confidently be expected from the application of this method.

"The method employed at most places on the Rhine proceeds upon principles the very reverse of this. The wine is left to ferment,

not in cool cellars, but in rooms, situate much too high and too warm; the access of air is completely precluded during the process of fermentation by tin-plate tubes, confined with water. These tubes certainly exercise an injurious effect upon the quality of the wine; they are, in every respect, futile—the invention of some idle brain; they serve no object, and yet they are used by people who are too indolent to inquire into the matter, and who are wholly incapable of assigning any reason for their adoption.

TO CORRESPONDENTS.

"R. A. S." (Totness), who desired an answer by post, is requested to send his address.

"A Subscriber" (Wincanton), who wrote to us about two months ago, is requested to enable us to address him by post.

"An Apprentice"—We know of no such means.

"P. S. H."—We have not had leisure to make the necessary inquiries for you, but you shall hear from us in a few days.

The Pharmaceutical Society is verifying our prophecies concerning it.

SUMMARY OF METEORLOGICAL OBSERVATIONS MADE AT OTLEY, YORKSHIRE, IN AUGUST AND SEPTEMBER, 1844.

BY E. THOMPSON.

AUGUST.

BAROMETER.

Monthly mean	29·59
Mean at 9 a.m.	29·52
,, at 3 p.m.	29·59
,, at 9 p.m.	29·61
Maximum on 31st	30·20
Minimum on 14th	29·12
Range	1·08

THERMOMETER.

Monthly mean	57°
Mean of maxima	66
,, minima	48
Maximum on 5th	74
Minimum on 28th	42
Range	32

Rain.—2·48 inches.

WIND.

Days.		Days.
N. 2		S. 0
N.E. 1		S.W. 2
E. 1		W. 15
S.E. 1		N.W. 6

WEATHER.

Days.		Days.
Clear	12	Rain 5
Cloudy	4	Thunder 2
Overcast	5	Lightning 2
Showers	8	Misty 1

GENERAL REMARKS.

The former part of the month was a continuation of wet weather, which has prevailed for some time. But on the 25th the weather became beautifully fine, and the temperature progressively increased to the end of the month. The grass has but just been secured, and the harvest has commenced with a prospect of a successful issue.

SEPTEMBER.

BAROMETER.

Monthly mean	29·89
Mean at 9 a.m.	29·90
,, at 3 p.m.	29·88
,, at 9 p.m.	29·91
Maximum on 2nd	30·25
Minimum on 16th	29·58
Range	·67

THERMOMETER.

Monthly mean	57°
Mean of maxima	67
,, minima	47
Maximum on 2nd	68
Minimum on 24th	38
Range	30

Rain.—2·75 inches.

WIND.

Days.		Days.
N. 0		S. 0
N.E. 3		S.W. 2
E. 4		W. 10
S.E. 0		N.W. 5

WEATHER.

Days.		Days.
Clear	11	Rain 3
Cloudy	12	Hail 0
Overcast	5	Lightning 1
Showers	5	Misty 1

GENERAL REMARKS.

Fine weather prevailed at the beginning and close of the month; about the middle a considerable fall of rain occurred. The harvest is just closed in this part of the country, the corn being chiefly housed in excellent condition.

Nota Bene.—*All Communications, Books for Review, and Substances to be Analysed, must be addressed "To the Editors of the Chemist, 310, Strand, London." Communications must be prepaid, and sent before the 15th of each month; Books for Review before the 10th.*

THE CHEMIST.

I. CHEMISTRY.

ON THE SUPPOSED COMBINATION OF HYDROGEN WITH IRON, BISMUTH, AND SULPHURET OF ARSENIC.*

BY DRS. J. SCHLOSSBERGER AND R. FRESENIUS.

DUPASQUIER states (*Comptes Rendus*, 1842, pr. sem. p. 511) that iron and hydrogen, on being brought into contact in the nascent state, form a gaseous hydroguret of iron. According to his assertion he obtained this compound whenever he put together iron, sulphuric acid, and water; or when he disengaged hydrogen, in the humid way, by means of iron. By burning the hydrogen with which this gas is impregnated, and a porcelain capsule being held against it, he recognised its presence, first, because the cooled flame became yellow in the circumference, and green in the centre, and next that spots of oxide of iron, of a rusty color, were frequently deposited on the capsule, presenting a metallic lustre. He further states that the supposed compound is not decomposed by a solution of potassa, but is decomposed by chlorine, iodine, bromine, and the salts of silver, gold, and mercury, the latter being reduced at the same time. From steel Dupasquier could obtain no hydroguret of iron; the flame of the disengaged gas was no longer green; its odor was empyreumatic; chloride of mercury was not precipitated by it; in short, it behaved not as a hydroguret of iron, but as carburetted hydrogen.

Meurer states in the *Archiv der Pharmacie* (2nd series, vol. xxxvi., p. 33), that by disengaging hydrogen by zinc, water, and hydrochloric or sulphuric acid, and adding chloride of bismuth, a gaseous combination of bismuth and hydrogen is obtained. He observes that hydrogen dissolves but a small quantity of bismuth, and this combination takes place only when water is decomposed with some energy; under this circumstance the flame of the escaping gas deposits spots on the porcelain, which are, however, of smaller diameter than those of arsenic, presenting a pale gray color, less variegated, and insoluble in Labarraque's liquid. The color of the burning gas is at the same time less white than when arseniuretted hydrogen is present.

In the same paper Meurer states, furthermore, that sulphuretted hydrogen, on being added to a liquid containing arsenic or antimony, and on quitting this mixture being brought into contact with zinc, water, and sulphuric acid, the disengaged hydrogen will contain in solution sulphuret of arsenic, or sulphuret of antimony, which appears by its being burned, when it deposits stains of arsenic or antimony.

These facts, if well founded, would have been of some importance for theoretical and practical chemistry; but the above labors not having been executed in such a manner as *à priori* to remove all doubts of their accuracy, we have examined and repeated them.

From the results of our experiments to be detailed in the sequel, it will first appear that the combinations of hydrogen in question do not exist; and it will next be shown what phenomena gave rise to the false inferences drawn by Dupasquier and Meurer.

With reference to the hydroguret of iron, we put into a glass phial a considerable quantity of finely-cut iron wire, disengaging hydrogen, partly with sulphuric, and partly with hydrochloric acid. This gas was first passed through two washing-bottles containing distilled water, and then through a glass tube four feet long, half of which was filled with moistened, and half with dry and loose, cotton. The gas, on issuing, presented its known nauseous and narcotic odor; and on being burned, it might, indeed be distinguished from pure hydrogen, in the manner stated by Dupasquier. In the centre of the flame a fine green cone was observed, similar to the flame of copper or boracic acid, which was the more manifest

* Liebig's *Annalen der Chemie und Pharmacie*, Sept. 1844.

he finer the aperture of the glass tube, and the more energetically the disengagement of the gas was urged; the cone was surrounded by a yellow circumference, much more luminous than the usual flame of hydrogen. This green color of the central portion of the flame is carefully to be distinguished from the accidental green which sometimes appears when a porcelain plate is held against the flame. It is known that hydrogen gas, the moment it issues from a tube, on being burned, and the flame cooled, the central portion of the flame becomes of a fine blue color, similar to that of oxide of carbon, whereas its peripheric portion is pale yellow, or almost entirely colorless; if, however, the hydrogen contains carburetted hydrogen, the flame presents an intense yellow tint, which, under certain positions of the eye, may cause the flame, on being cooled by porcelain, in some places to appear of a green color, from the blue and green rays of light coinciding. That spots, as described by Dupasquier are noticed, we must likewise admit; but we disagree with reference to the account given of their nature. We, before all, remark, that to purify hydrogen satisfactorily from foreign substances which mix with it in the bottle in which the gases are disengaged, our washing apparatus is indispensable; for not only did we notice most clearly traces of salts of iron in the first washing-bottle, and, though to a less extent, these could not be overlooked even in the second bottle; but in one of our experiments it happened that, on disengaging gas for some hours; the cotton itself placed in the anterior portion of the glass tube, though previously sufficiently washed with hydrochloric acid free from iron, became impregnated with traces of iron, yet in the second portion of the glass tube iron was never met with. When we employed merely a simple washing-bottle, setting fire to the gas, we obtained a large quantity of yellow spots, mixed with some gray ones, a portion of which were easily soluble in hydrochloric acid, decidedly behaving like iron. With reference to this circumstance, we made an additional experiment by placing a salt of iron into the bottle from which hydrogen was disengaged by zinc; on setting fire to the gas obtained in that manner, when once washed, we could under no circumstances produce spots. This observation, at first, seems to corroborate the assertion of the presence of oxide of iron; but such a supposition falls to the ground, on treating the gas by a perfectly satisfactory washing apparatus. Even in the latter case, it is true, are almost always obtained yellow, and sometimes gray stains possessed of an intense lustre, but of an essentially different constitution. They are first rather easily volatilised by heating strongly the porcelain capsule, and exposing to the flame, for a longer time, the same point; next they are insoluble in hydrochloric acid, but soluble in *aqua regia*, chiefly on applying heat. The solution, on being treated with chloride of iron, or acetate of ammonia, or other reagents, indisputably shows a portion of phosphoric acid; whereas not the slightest vestige of iron was discovered in it.* The spots, on being moistened with water are of a strong acid reaction, proving to be a coating containing phosphorus, with which, by all means, phosphoric acid is mixed. This gas, on being purified according to our directions, and passed through a solution of chloride of mercury, soon rendered this liquor turbid, and on having allowed the gas to pass for six hours, a large yellowish-white precipitate was deposited, the cause of which, according to direct experiments instituted by ourselves, could not have been either pure hydrogen, or marsh gas, or bicarburet of hydrogen. It was filtered off, and the filtered mass, having been entirely freed from mercury by most carefully washed sulphuretted hydrogen, and from sulphuret of mercury by filtration, *aqua regia* being added and concentrated, on being treated by acetate of potassa with ferrocyanide of potassium, or by ammonia and sulphuret of ammonia, or, finally (being previously diluted), by sulphocyanide of potassium, the most delicate reagent for oxide of iron, neither coloration nor any precipitate was obtained. The yellowish-white precipitate on being washed, was found to be not altogether insoluble in water, and became more intensely yellow, and contained mercury, chlorine, phosphorus, and sulphur. Covered by carbonate of soda it became black; the chlorine was found in the liquid filtered off, and the mercury in the residue; having previously detonated a portion of the precipitate with nitre, we demonstrated the presence of phosphorus and sulphur in their acids.

The washed gas being transmitted through a solution of sulphate or acetate of copper, rather a considerable quantity of a brown-black precipitate of phosphoret and sulphuret of copper was formed. On collecting the gas over water impregnated with

* We think it will not be immaterial expressly to remark that, to obtain this result, it was necessary most carefully to avoid any impurity with iron (which might be caused by the vessels or substances employed for solution, or dust).

chlorine, this remained entirely free from iron. By employing iron nails instead of wire we obtained quite the same results. After these experiments no doubt remains that, *at least in the manner mentioned, a gaseous combination of iron and hydrogen cannot be obtained*, and it may easily be perceived that the reactions which Dupasquier intends to attribute to hydroguret of iron, originate from *phosphoretted hydrogen*, which for the most part is mixed with sulphuretted hydrogen. It is known that phosphoretted hydrogen is not decomposed by a solution of potassa, but that it is decomposed by chlorine, bromine, iodine, and by the metallic salts which Dupasquier enumerated; and if it is asked why Dupasquier obtained no hydroguret of iron from steel, we answer that he then must have had to deal with a species free from phosphorus or containing but little of it. The spots which Dupasquier obtained consisted, therefore, of phosphorus, with which, however, in consequence of imperfect washing of the gas, some particles of iron might certainly have been mixed. We do not venture to decide upon the nature of the phosphorus existing in these spots; most probably they consisted of oxide of phosphorus mixed with phosphoric acid. In conclusion, we observe that the formation of these stains may, by certain circumstances, become more difficult, or be altogether prevented. We single out as such if the aperture of the tube from which the gas issues is too large, or if the cold applied was insufficient; in that case nothing but phosphoric acid is formed, as may easily be demonstrated with litmus paper.

Our second investigation relates to the nature of the supposed *hydroguret of bismuth*. With this view we disengaged hydrogen by pure zinc and pure hydrochloric acid, adding, through the funnel tube, a solution of pure chloride of bismuth, taking the necessary precautions (mentioned above) that no trace of bismuth should be mechanically carried over, and set fire to the gas issuing from the tube drawn out at that extremity. The color of the burning gas was that of pure hydrogen; on the porcelain it deposited no stains whatever. The results were perfectly the same, whether the disengagement of the gas was feebly or most energetically urged. To be more fully convinced, we passed the gas, which was continually disengaged with some vehemence through hydrochloric acid, to which, from time to time, pure subchlorite of lime was added in such a manner that the mixture always exhaled a strong odor of chlorine.

On terminating the experiment we applied heat till the odor of chlorine entirely disappeared, and divided the solution into two portions; through the one we immediately passed a stream of sulphuretted hydrogen, the other we treated with the same gas, but only after having previously diluted it with water: no trace of bismuth could be discovered in either of these two portions. The contents of the washings of the bottles through which the gas was passed for two hours, were evaporated with nitric acid, and then decomposed by sulphuretted hydrogen. Here, likewise, no bismuth was detected, but a perceptible quantity of chloride of zinc was met with. This fact is to be explained by the circumstance that chloride of bismuth, on coming in contact with zinc, is instantly reduced, by which its being mechanically carried over is prevented. These results again evidently prove the *non-existence* of a hydroguret of bismuth to be obtained in that manner, but did not, however, lead us to detect the cause of the error which induced Meurer to form his hypothesis. We arrived at this by a new experiment.

To bring bismuth and hydrogen in contact in the nascent state in another manner, we prepared an alloy of sodium, mercury, and bismuth, and put this into water. The bismuth employed was that of commerce. We obtained hydrogen which burned with a bluish-green flame, and, deposited on porcelain, perceptible spots, being, on close examination, found to be stains of pure antimony. We obtained exactly the same by dissolving the bismuth of commerce in *aqua regia*, and putting the solution into a common Marsh's apparatus. The quantity of stains collected in that case was so considerable, that their nature could be ascertained with facility. Their solution in *aqua regia*, on being evaporated with hydrochloric acid, gave, with sulphuretted hydrogen, a pure orange-yellow precipitate, which was completely soluble in sulphuret of ammonia. Whether the stains, besides antimony, contained likewise arsenic, was immaterial for our purpose, and was, therefore, not further examined. Meurer having considered the stains obtained by himself to be bismuth, only because he proved that they were not arsenic, we think that, based on our experiments just related, we are the more warranted in the assertion that the specimen of bismuth, with which he made his experiments, must have contained antimony. To prepare the bodies in question, the *sulphuret of antimony and sulphuret of arsenic dissolved in hydrogen*, Meurer placed in a Marsh's apparatus a solution of antimony or arsenic, together with sulphuretted hydrogen, or, in other terms, freshly precipitated sulphuret of antimony or sulphuret of

arsenic. This mixture, therefore, if it is not maintained that the sulphuretted hydrogen was precisely in the exact proportion requisite for the decomposition, must have contained either sulphuretted hydrogen in a free state, or an undecomposed salt of antimony or arsenic. To study the process in the most simple conditions, we placed in the apparatus zinc, hydrochloric acid, water, and pure hydrated sulphuret of antimony, passed the gas through a long tube, which we filled with cotton, and set fire to it. We obtained very large quantities of dark orange stains of sulphuret of antimony. The observation was then here likewise perfectly true, but less so the consequences drawn from it. Instead of asserting, what contradicts all analogy, that the sulphuret of antimony was dissolved in hydrogen, and carried over by it, the supposition is much nearer that *sulphuretted hydrogen and sulphuret of antimony are contemporaneously formed*, and on their combustion, the sulphur and the antimony being both separated from their combinations by the cooling of the flame, unite again, forming sulphuret of antimony. If this supposition was correct, it must have been corroborated; when, instead of setting fire to the gas, the tube through which the gaseous mixture passed, was heated to redness in one particular place; or, if the gaseous mixture was transmitted through a solution of potassa. On making the former of these experiments, we noticed, first, a yellowish-white coating of sulphur, and on raising the temperature of the tube behind the former, a black one of antimony; on continuing to heat, as a secondary product, sulphuret of antimony was noticed, which was formed either by the action of the current freshly following sulphuretted hydrogen upon the antimony already deposited, or by the direct combination of the separated sulphur and antimony at a higher temperature.

The result of the next experiment, still more strikingly proved the correctness of our inference. The gaseous mixture, on being passed through a solution of potassa, left therein its sulphuretted hydrogen—pure antimoniuretted hydrogen issued from he washing-bottle. The stains which the latter formed on being ignited were of a pure black; they contained no trace of sulphur. This latter substance was entirely found in the solution of potassa, which, on being supersaturated with hydrochloric acid, largely disengaged sulphuretted hydrogen, and on being mixed with a solution of lead, threw down a copious black precipitate. Finally, to remove all doubts with reference to our manner of explaining the phenomenon, we adopted the synthetic method. We disengaged in separate apparatuses sulphuretted hydrogen and hydrogen impregnated with antimoniuretted hydrogen, directing these gases through different tubes into a bottle provided with three necks, allowing the gaseous mixture to escape through the tube adapted to the third neck. Fire being set to it, stains of the finest orange color of sulphuret of antimony were deposited on the porcelain, which it was in our power to obtain in the greatest variety of shades of yellow, red, and brown, according as we allowed either the antimoniated hydrogen or the sulphuretted hydrogen to prevail; in the first case, besides sulphuret of antimony, we obtained antimony in a free state; in the second case, some sulphur was in a free state. On heating one portion of the tube through which the gaseous mixture passed, this portion was precisely in the manner described above; firstly, covered by a white coating of sulphur, and next by a darker one of antimony; afterwards, as a secondary product, sulphuret of antimony was formed.

Completely analogous results were obtained when, instead of the hydrated sulphuret of antimony, we employed sulphuret of arsenic. The disengaged gaseous mixture, on being heated in the tube, yielded, first, a coating of sulphur, then deposited arsenic, finally forming sulphuret of arsenic. The gas, on being burned, gave yellow stains of sulphuret of arsenic, which were entirely soluble in ammonia. On being passed through a solution of potassa, it gave stains of pure arsenic; the sulphuretted hydrogen was retained by the potassa. In these experiments, however, the hydrogen disengaged was impregnated with foreign gases to a much less extent than in the case of sulphuret of antimony being employed, manifestly, because sulphuret of arsenic is much less soluble in hydrochloric acid than sulphuret of antimony. Orpiment, reduced to powder, on being put into Marsh's apparatus, gave no stains. If, on throwing liquid sulphuretted hydrogen into Marsh's apparatus, hydrogen is mixed with sulphuretted hydrogen, the cooled flame furnishes pale yellow stains of sulphur, which are insoluble in ammonia, and the disengaging tube being heated, a coating of pure sulphur is formed.

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ON LIMON.*

BY DR. C. SCHMIDT.

The rage for discovering alkaloïds in every vegetable substance which is of a bitter taste, and has become an object of *materia medica*,

* *Ann. der Chem. u. Pharm.*, Sept. 1844.

and to call it so, even without investigation, in our days, is fortunately on the decrease. In former times, when the means of controlling such assertions, as elementary analysis, &c., were but imperfect, it created great confusion in science; hence it naturally follows, that with all deference to the merits of any discoverer, we look upon similar new statements with diffidence, and subject them to rigorous investigations. This circumstance induced me to investigate anew the crystallisable matter which Fr. Bernays *(Buchner's Repertorium*, vol. xxi., numb. 3, p. 306, &c.) discovered in the seeds of lemons and oranges, and described under the name of *Limonin*. Professor Wöhler, in whose laboratory I undertook the present operation, was in possession of a small quantity of this substance, extracted from the seeds *(a)* of oranges, *(b)* of lemons, and had the kindness to give it to me for an accurate examination.* To the naked eye the substance appeared to be a white crystalline powder; by the microscope I was soon convinced that it belonged to the rhombic system (1 and 1 axis), since, besides several other combinations, the simple vertical rhombic prisma (∞P . oP) was observed, the angle of which, approximatively measured by the aid of the camera clara, amounted to 125°. Some horizontal makrodiagonal and bracbydiagonal prisms appeared as obtundities of the *corner* formed by oP and ∞P the homonymous planes of these obtundities of the sharp and obtuse lateral edges of the fundamental form. Pyramids of the principal or secondary series could not be detected; it lies, however, in the nature of the thing, and whoever is in the habit of examining microscopic crystals knows it by experience, that when complicated combinations are developed, mistakes may happen, and that, especially subordinate planes, are easily overlooked or misinterpreted; hence the non-existence of pyramids is by no means considered as certain.

The so-called Limonin is very difficultly soluble in water, ether, and ammonia, somewhat easier in mineral acids, easier still in alcohol and acetic acid, but most easily in potassa, from which solution it may again be thrown down unchanged by the acids. In concentrated sulphuric acid it is dissolved with a blood-red color, from which, as well as from an alcoholic or acetic solution, it is thrown down by water unchanged; being heated, it becomes carbonised; with carbonate of baryta it is neutralised, no baryta remaining in solution. This substance crystallises easily from acetic acid; the crystals having the same appearance as those obtained from alcohol. On close examination it was found that no trace of acetic acid had combined with it. The alcoholic solution is of a neutral reaction, it gives no precipitate on being treated either with chloride of platinum, chloride of mercury, or with salts of lead, silver, lime, baryta, or other salts (the latter must, of course, be dissolved in alcohol, otherwise the pure substance would be thrown down by the water of the saline solution). It may be heated up to 392°F. without undergoing any change, or experiencing any perceptible loss of weight; at a higher temperature it becomes yellowish, fusing at 471° F., presenting the same color throughout. It is a clear, resinous liquid, which, on becoming solid, is amorphous, presenting, even after several days, no vestige of a crystalline structure; redissolved, however, in acetic acid, heat being applied for a longer time, it crystallises with the appearance and properties which the substance presented previous to its being fused. The stability of this substance, on being brought into contact with, bodies endowed with the power of oxidising, is remarkable; in concentrated surphuric acid it is dissolved especially under the influence of heat, the solution presenting a feeble yellow color, from which even on being exposed to a longer action, it is thrown down by water, in an unchanged state. On being boiled with a concentrated solution of chromate of potassa, there is no perceptible trace of reduction or any other change; the same negative result is obtained on treating it with free chromic acid, that is, with chromate of potassa and sulphuric acid; even if the boiling is continued for several hours, it merely swims therein unchanged, and the color of the liquor is as unaltered as it was before. The acetic solution is of a very bitter taste, the physiological effects, however, seem to be inconsiderable. One morning before breakfast I took sixty milligrammes of it dissolved in acetic acid, but experienced no particular effect, either the same day or on any of the following ones; the same happened with a dog to which I administered 25 milligrammes; nor could I discover it in the urine. It was the same when 10 milligrammes were introduced into the intestinal canal of a bird (fringilla canabina) or 10 milligrammes of it dissolved in potassa were injected into the posterior lymphatic heart of a frog (in the ischiatic region under the skin); precisely the same symptoms

* It was prepared by Mr. Simon, of Berlin, who, with the most obliging readiness, devoted to these investigations the small quantity of this rare substance, obtained from a great amount of seeds.

were produced which were noticed in another animal of the same size, in consequence of a similar operation on administering the same quantity of pure potassa. Upon its pathological effects I cannot decide, since neither substance enough nor patients laboring under intermittents were at my disposal.

The elementary analyses yielded the following results (substance dried at 248°F., combustion with oxide of copper in a current of oxygen) :—

FROM ORANGES (*a*).

I. 0·375 substance gave 0·907 CO^2, and 0·219 HO.

II. 0·4065 substance gave 0·9845, CO^2, and 0·2405 HO.

FROM LEMONS (*b*).

III. 0·362 substance gave 0·870 CO^2, and 0·206 HO.

Hence in 100 parts :—

	I.	II.	III.
C=	66·04	66·13	65·62
H=	6·49	6·57	6·32
O=	27·47	27·30	

Calculated according to

C=75·12
H=12· 5

An inconsiderable loss of CO^2 and HO occurred in experiment III. by the bursting of the combustion tube at the end of the operation, yet by the other reaction it appears that the identity of *a* and *b* admits of no doubt.

0·2428 of substance of orange seeds were calcined with lime and soda according to Varrentrapp and Will's method for the determination of nitrogen ; *no trace* of chloride of platinum and ammonia was obtained. This substance is therefore free from nitrogen, in no respect analogous with alkaloïds, and most willingly assenting to the proposal of Professor Wöhler to strike off from this word the termination "in," which is only to be employed in the case of alkaloïds, I shall, therefore, in future designate the substance in question by the term *Limon*.

This Limon, with reference to all its properties, resembles those crystalline substances mostly of a bitter taste, and rather of an indifferent character occurring in their impure or decomposed state under various heads, as "bitter extractive substances;" in the manner of acids and alkaloïds, different kinds of wax, resin, and fat, forming natural groups, a real passage of the series of the hydrocarbons (on the characteristics of which I lately communicated a short article in the same volume of these annals [Liebig's]) into that of oils and resins. This substance, for instance, presents a striking resemblance to columbin, discovered and examined in 1830, by Wittstock (*Poggend. Annalen*, vol. xix., p. 298), the crystalline form of which was described by G. Rose (*Ibid*, p. 441), its elementary composition having been found by Liebig. This substance may serve as a type of the whole group of those bodies, a group which is not deficient with regard to a store of names, but in which well-founded examinations are wanted. Columbin so much resembles limon, which probably is proper to all seeds of the aurantiaceæ, that I should have considered these two bodies as identical ones, if with reference to hydrogen the analytical results obtained by Liebig (assuming C= 75·12)—

C=67·53
H= 6·17
O=28·70

had not too much differed from that made by myself, and if the columbin had not been so difficultly soluble in ether. The resemblance, however, with regard to the crystalline form (Rose found the principal form to be a light rhombic prism of 125° 30′), and the other physical and chemical properties are uncommon.

On the perusal of the last volumes of the *Comptes Rendus*, I find (vol. xv, p. 802) a work of Dr. Scribe on a similar bitter and crystallisable substance, which he found in Cnicus Benedictus, and called cnicin, which the author endeavors to class among the series of the phloridzins, notwithstanding it differs from them in all other respects ; though, on account of the impossibility of obtaining combinations of this body with other substances, he succeeded no better than myself in ascertaining the atomic weight of this matter. It resembles limon in its properties, except that it is soluble in water. The most probable of its analyses (taking C=75·12) gives :—

C=62·97
H= 6·89
O=30·14

If it is attempted to calculate this by the amount of carbon in phloridzin (42 eqvs.), the following formula naturally results ;—

$C^{42}\ H^{27}\ O^{15}$

which requires

C=63·19
H= 6·76
O=30·05

If this be applied to the analytical results found by myself with reference to limon, then for instance the formula—

$C^{42}\ H^{25}\ O^{13}$,

that is cnicin—2HO would require the following composition :—

C=66·17
H= 6·55
O=27·32

numbers which are in accordance with those found; and the question would arise whether this limon, on being treated by acids, heated with water under a higher pressure, could not perhaps be transformed into the above-mentioned cnicin, and accordingly comport itself like sugar, starch, gum, or wood-fibre, &c.; but I regret that want of material prevented me from entering into any of these points.

Phloridzin on being dried at 212°F. was = C^{42} H^{25} O^{11}, that is, it contained 2O less than limon. The question whether it could not be produced from that by substances proper to reduce other bodies, considering the manifestly indifferent character of all these substances, was of some interest. Without any result I exposed it to the action of sulphurous acid, sulphuretted hydrogen, hydrochloric acid, to hydrogen in its nascent state, that is to zinc and acids, to moistened ammonia, by the known reaction of which the smallest amount of the formed phloridzin could not have escaped my notice, no trace of the characteristic blue coloration was perceived. It naturally follows that phloridzin decidedly belongs to a different group of bodies, and in addition to these its indifferent behavior with reference to chromic acid and its salts, speaks for the assertion that it is entirely different from the series of salicin.

An experiment with the trifling remainder of substance still in my possession gave no certain results; yet will I communicate it as a supplement. About 20 milligrammes were hermetically closed in a glass tube, heated therein for four hours at a temperature of 392°F. On looking at it at first, nothing seemed to be changed, but an exact microscopical investigation showed that instead of the original numberless crystals, there appeared solid globules very much resembling oily drops, strongly refracting light, whereas a grainy crystalline substance, on evaporation of the aqueous liquor, remained on the object bearer. On this transformation into the amorphous state, and some phenomena of crystallisation, I hope to treat more fully on another occasion. Whether the dissolved substance was cnicin or not I am unable to decide. —nt—

ON THE ACTION WHICH IODINE EXERTS ON CERTAIN SALTS, AND ON THE PRODUCTS WHICH RESULT FROM IT.*

BY M. FILHOL.

Some years ago, M. Berthemot first produced a compound of iodine and lead, of a beautiful blue color; this compound was a short time afterwards mentioned by M. Denot, finally, it was more recently studied by M. Durand.

In order to establish its chemical composition, I first studied that of the solutions used for producing it; this first part of my work relates to the study of the action which iodine exerts on the carbonates. The result of my experiments proves that iodine acting without heat on the alkaline carbonates, forms bicarbonate of the base, iodide, and iodate.

By studying the action which a solution of biniodide of potassium exerts on a solution of acetate of lead, I succeeded in producing a very unstable precipitate of a violet red; this compound heated to 230° F., leaves 26·66 per cent., or 1 equivalent of iodine, and leaves a residue formed of $I^2Pb+PbO$. If care be taken not to exceed 230° F., this residue is of a fine green; but if the temperature be raised to 270° or 280°, it loses its green color, without losing the slightest trace of iodine.

The composition of this red powder is such, that it may be regarded as formed of biniodide of lead combined with oxide of lead $(2I^2 + Pb) + PbO$, or else as formed of $I^2Pb + I^2PbO$.

Treated by an excess of acetic acid this powder is decomposed, iodine is liberated, oxide of lead is combined with acetic acid, and there remains, as a residue, a new oxyiodide of lead, formed of $2I^2Pb + PbO$.

I finally prove, in the latter part of my work, that this red powder constitutes one of the elements of the blue compound, of which I have already spoken; and that it is sufficient, for producing this latter, to put the red powder, whilst still moist, in contact with carbonate of lead in the nascent state; or, better still, to use a solution which produces both at the same time. The blue powder constitutes a compound of a new kind, and I propose to give it the name of *iodo-carbonate* of lead.

It is obtained in a very beautiful state by using, for precipitating a solution of acetate of lead, a solution formed of one proportion of biniodide of potassium, and of another of carbonate of potassa.

Finally, I give the means of converting ordinary yellow iodide of lead into a powder of a beautiful blue.

The analysis of a beautiful sample of this blue compound led me to assign to it the formula:—

$$I^2Pb+I^2PbO+4(C^2O^2PbO).$$

* *Comptes Rendus*, No. 16, Oct. 14, 1844.

ON THE PREPARATION OF THE XANTHOGENATE OF POTASSA, AND ON THE PRODUCTS OF ITS DECOMPOSITION BY HEAT.*

BY DR. F. SACC.

When in preparing xanthogenate of potassa, the common alcohol of commerce is employed, the salt spontaneously separates only at a very low temperature, without the addition of ether. The mixture is then to be evaporated in a water-bath, which may easily be effected by keeping the temperature below 122°F.; if the heat, however, be raised beyond this point, the liquor becomes of a deep orange yellow, in consequence of a decomposition which takes place, the more rapidly the nearer the temperature approaches to 212°F. The coloration mentioned originates from a substance, which is deposited on the bottom of the retort in the form of a heavy oil of a deep orange yellow color. This liquid, on being concentrated, yields a considerable quantity of fine crystals, which very much resembles sal-ammoniac; these crystals are sulphocarburet of sulphuret of potassium, containing, as an impurity, traces of sulphuret of potassium, which originate from a more advanced decomposition. Exposed to the air, they very soon lose their original yellow color, and without the separation of sulphur, but with disengagement of sulphuretted hydrogen they are completely transformed into the bicarbonate and subsulphite of potassa.

The decomposition which the xanthogenate of potassa undergoes when still below 212° F., is expressed by the following equation:—

$$\left.\begin{matrix} S^2C,\ C^4\ H^5O \\ S^2C,\ \ \ \ KO \end{matrix}\right\} + 2HO = S^2C,\ SK + \underbrace{C^4H^5O,\ HO} + HS + CO^2$$

Xanthogenate of potassa. Alcohol.

From this equation it appears that each equivalent of xanthogenate of potassa, in uniting with the elements of two equivalents of water, produces one equivalent of sulphocarburet of sulphuret of potassium, and one equivalent of alcohol, when, at the same time, as is proved by experiment, one equivalent of sulphuretted hydrogen and one equivalent of carbonic acid are disengaged. That the salt formed of the orange-yellow liquor, on being exposed to air is decomposed, may easily be accounted for by assuming that two equivalents of sulphocarburet of sulphuret of potassium, with four equivalents of water, attracting from the air four equivalents of oxygen are transformed into:—

$$2\ (S^2C,\ SK) + 4HO + 4O = 2CO^2,\ KO + 4HS + S^2O^2,\ KO.$$

The easiest and surest method of preparing the xanthogenate of potassa is the following:—Absolute alcohol is saturated with pure hydrate of potassa, and added to an excess of bisulphuret of carbon. The two liquids on being mixed instantly become solid, presenting a mass of light yellow, silky, interwoven needles; these are thrown on a filter, and rapidly washed with ether. The crystals are first to be pressed between blotting-paper, and then dried in a bell jar over concentrated sulphuric acid.

If dry xanthogenate of potassa be mixed with a quantity of water not sufficient completely to dissolve it at a cold temperature, and if this mixture be distilled over a gentle charcoal fire, at a temperature of from 86° to 95° F., the bottom of the retort begins to become of an orange-yellow color. In proportion as the temperature rises, this coloration becomes more extended: at 185° F. it is most developed; at 212°, with disengagement of gases, it becomes darker, and two liquids of different densities, exhaling the odor of mercaptan, pass over.

The heavier liquor is at first transparent, very soon presenting, however, on its surface white points, which, on being exposed to the air, gradually become enlarged, covering the liquid, and after the lapse of one day are transformed into a white powder, which falls to the bottom, and is merely finely-divided sulphur. The orange-yellow liquor which remains in the retort, on being evaporated, does not crystallise; its color indicates the presence of bisulphuret of potassium, which apparently originates from the carbonic acid decomposing a certain quantity of the simple sulphate of potassium, the direct product of the reaction.

The liquor which passes over is a mixture; to separate its components, it must be shaken with pure water, the latter fluid is to be removed by the pipette, supersaturated with carbonate of potassa and distilled in a water-bath: that which now passes over is pure alcohol. The portion which was not dissolved in water, is to be mixed with chloride of calcium and distilled; bisulphuret of carbon alone passes over. The alcohol, as well as the bisulphuret of carbon, obtained in this manner, exhales the odor of mercaptan, which is admixed in so small a quantity that it cannot be weighed. The following

* Liebig's *Annalen der Chemie und Pharmacie*, September, 1844.

equation expresses the decomposition, which takes place with the co-operation of two equivalents of water :—

$$\left.\begin{matrix} S^2C, C^4H^5O \\ S^2C, KO \end{matrix}\right\} + 2HO = C^4H^5O, HO + S^2C + SH + CO^2 + SK.$$

Xanthogenate of potassa, on being subjected to dry distillation over a charcoal fire, the heat at the same time being raised to 392° F., becomes of a fine orange yellow, the coloration progressing from the circumference towards the centre ; but this color is gradually changed into black : two liquors of different densities, in conjunction with sulphuretted hydrogen and oxide of carbon, pass over. Bisulphuret of potassium and charcoal remain in the retort.

From the liquid which passed over, water extracts nothing ; hence it contains no alcohol. On being mixed with an excess of chloride of calcium, it yields to it part of its water, being transformed into an homogeneous oily liquid, which exhales a most fetid odor ; and, although insoluble in water, bestows on that latter fluid its own odor. It precipitates salts of lead with a yellow color, and no drops of bisulphuret of carbon being then separated, is a positive proof of the absence of the latter body. It combines with oxide of mercury, with a violent disengagement of heat, forming a solid mass, which, on being dissolved in boiling alcohol, and allowed to cool, forms scales of a silvery lustre. The distilled mass, therefore, consists of pure mercaptan and a small quantity of water. On distilling in an oil-bath at a temperature of 392° F., except some traces of bisulphuret of carbon, the products remained the same. The residue in the retort is never completely decomposed ; hence its analysis is impossible. By operating on an open fire, then, as stated already, nothing but bisulphuret of potassium remains, which is soluble in water and alcohol, whereas a great quantity of coal remains undissolved, which is thrown down in the form of shiny bracteæ.

In this decomposition, two atoms of xanthogenate of potassa enter into action, as appears by the following equation :—

$$2\underbrace{\left\{\begin{matrix} S^2C, C^4H^5O \\ S^2C\ KO \end{matrix}\right\}}_{\text{Xanthogenate of potassa.}} = \underbrace{C^4H^5S, HS}_{\text{Mercaptan.}} + 2HS + 2HO + 2CO + 2S^2K + C^6.$$

The described experiments show that, among the products obtained by distilling the xanthogenate of potassa, at variance with a French chemist, I could not discover any of the various new bodies. Three consecutive experiments, instituted with great quantities of substance, led to the very same result, leaving no doubt with reference to this point.

On comparing this process of obtaining mercaptan from the xanthogenate of potassa with the usual one, it appears at one glance that in both cases this combination is produced by the mutual action of oxide of ethule and sulphuretted hydrogen the moment they are separated from a body in which they have been combined in another manner. Hence it seems to me that, on distilling pure and perfectly dry xanthogenate of potassa, nothing can be obtained but hydrosulphuret of the sulphuret of ethule (mercaptan).

SUMMARY.

The xanthogenate of potassa in the presence of water, at a temperature of 212° F., is decomposed into sulphocarburet of sulphuret of potassium, alcohol, sulphuretted hydrogen, and carbonic acid ; at 392° F., into alcohol, bisulphuret of carbon, simple sulphuret of potassium, water, sulphuretted hydrogen, and carbonic acid.

On a dry distillation from 212° F. to a red heat, the xanthogenate of potassa is decomposed into mercaptan, bisulphuret of carbon, water, oxide of carbon, bisulphuret of potassium, and charcoal. —nt—

ON SOME REACTIONS OF BICHLORIDE OF MERCURY.*

BY M. E. MILLON.

Bichloride of mercury is not decomposed by bichromate of potassa, however concentrated the two saline solutions may be. But if a mixture of the two salts be made in the proportion of one equivalent of each, and dissolved with the aid of heat, as the liquor cools, there is a very abundant crystallisation of a fine, red, hard, and very friable compound : this salt may be redissolved in water and recrystallised.

The crystals are ordinarily grouped in stars, and present separately the form of a right rhomboïdal prism, terminated by the pyramids of the rhomboïdal octahedron. The powder of this salt is of a bright yellow ; heat decomposes it, volatilising bichloride of mercury ; the separation thus effected may enable us to fix the composition of the salt ; however, a very small quantity of oxide of chromium is produced.

* *Comptes Rendus*, No. 16, Oct. 14, 1844.

But the analysis is performed in the clearest manner, by means of ether, which leaves the bichromate of potassa intact. The form of the crystals is even retained, although not a trace of bichloride remains; it is thus found that the salt uniformly loses 47·5 per cent. of its weight, which leads to the following formula:—

$$2\,(Cr\,O^3)\,KO + Hg\,Cl.$$

Absolute alcohol exerts an action analogous to that of ether.

It was in vain endeavored to produce a similar compound with the other metallic chlorides. The chloride of potassium, indeed, furnishes a liquid of a black-brown color, but it is impossible to separate from it any product which appears to be definite.

This peculiar combination of the bichloride reminds us of the perfectly exceptional manner in which the same compound acts with the acids: thus it is known that sulphuric acid, concentrated or diluted, does not decompose bichloride of mercury; it is the same with nitric acid, in which sublimate is formed by the addition of hydrochloric acid. Iodic acid does not precipitate the bichloride, although the iodate of the binoxide is entirely insoluble in water. In a word, bichloride of mercury, notwithstanding its solubility, resists the general effect of energetic acids, which always act on the elements of the chlorides dissolved, taking the base, and eliminating the hydrochloric acid.

But if the bichloride of mercury resists affinity in the way in which it is ordinarily exerted, it yields to it, by a very remarkable contrast, in a way in which the affinity of the chlorides is rarely developed. Thus, in bichloride of mercury, it is the chlorine that directly tends to quit the metal, and the elements of water do not interfere in the reaction, even in an aqueous solution; the same tendency is also manifested when absolute alcohol is used as a solvent. I might here detail the organic decomposition, in which bichloride of mercury is found reduced; but the character which I have pointed out is not yet sufficiently manifested in them. The action of iodine on bichloride of mercury very clearly signalises this special disposition of the combined chlorine and mercury. Iodine really displaces the chlorine, and forms at the same time chloride of iodine and iodide of mercury.

It might be thought that this decomposition, the inverse of that which is exerted with respect to all other metals, is due to the insolubility of the bichloride of mercury, but it is not so. The decomposition is effected only precisely in the ratio of the solubility of the bichloride of mercury in the solvent medium; thus it is almost imperceptible when an aqueous solution of the bichloride is employed, whilst it may be complete with an alcoholic solution. By the evaporation of the alcohol containing the iodine and bichloride in solution, fine red crystals of biniodide of mercury are collected. This phenomenon led M. Lassaigne into error, and caused him to describe (*Annales de Chimie et de Physique*, 2 série, t. lxiii., p. 106) a very strange compound of bichloride of mercury and iodine, which does not exist. He based its existence on a reaction, in other respects very interesting, of bichloride of mercury on iodide of starch; the latter is decolored by the bichloride, which removes from it the iodine, forming biniodide of mercury and chloride of iodine, both without apparent action on the starch; but the blue color is easily restored by a drop of iodide of potassium, which reacts on the chloride of iodine, and liberates the iodine.

This rendered it probable that iodide of mercury would not be attacked by chloride of iodine, and this, indeed, is confirmed by experiment. Iodide of mercury constitutes an exception, in this particular, to all the metallic chlorides.

M. François Salmi, in a note on the solubility of iodine in saline liquors (*L'Institut*, January 2, 1844), showed that iodine disappears in an aqueous solution of bichloride of mercury; but the perfectly exceptional nature of the reaction had not occupied his attention.

I should add, nevertheless, that the affinity of iodine for mercury is not greater than that of chlorine when solvents are not employed. Thus, in an atmosphere of chlorine, if the latter gas be in great excess, the biniodide of mercury is entirely converted into bichloride.

ON THE ORIGIN OF ALBUMEN IN PLANTS.*

BY PROFESSOR LIEBIG.

According to Mulder, fibrin and coagulated albumen, air being kept from them, are slowly dissolved in strong hydrochloric acid, presenting a straw-colored liquid, which, on coming into contact with oxygen, absorbs this gas, turning finally into a black color. There are formed sal-ammoniac and humic acid, or rather a substance offering a combination of ammonia, which may be directly produced by treating sugar with hydrochloric acid [nitric?]. The residue left, on evaporation to dryness, the solution after

* Liebig's *Annalen der Chemie und Pharmacie*, August, 1844.

it became black, according to Mulder's analysis, was composed as follows :—38·28 carbon, 6·12 hydrogen, 11·09 nitrogen, 22·65 oxygen, 21·86 chlorine; hence Mulder deduces the formula :—

H = 6·25; N = 88·52; Cl = 221·32.

$C^{40}\ H^{78}\ N^{10}\ O^{20}\ Cl^{6}$.

Protein	C^{48}	N^{12}	H^{72}	O^{14}	
Water			H^{12}	O^{6}	
Oxygen				O^{4}	
Hydrochloric acid			H^{10}		Cl^{10}
	C^{48}	N^{12}	H^{94}	O^{24}	Cl^{10}

or of

Gum	C^{48}		H^{40}	O^{24}	
Ammonia		N^{2}	H^{6}		
Sal ammonia		N^{10}	H^{40}		Cl^{10}
	C^{48}	N^{12}	H^{94}	O^{24}	Cl^{10}

To this analysis no less exactly corresponds the formula :—

$C^{48}\ N^{12}\ H^{94}\ O^{24}\ Cl^{10}$.

According to these numbers, the products obtained by treating fibrin or albumen in the presence of oxygen with hydrochloric acid, are composed of the following elements :—

The principal organic matter of animal substances may therefore be considered to have originated from the combination of sugar with ammonia, the elements of water and oxygen separating at the same time.

Sugar	C^{48}		H^{96}	O^{48}
Ammonia		N^{12}	H^{36}	
	C^{48}	N^{12}	H^{132}	O^{48}

or of

Protein	C^{48}	N^{12}	H^{72}	O^{14}
Oxygen				O^{4}
Water			H^{60}	O^{30}
	C^{48}	N^{12}	H^{132}	O^{48}

I made this deduction in the fifth edition of Geiger's *Handbuch*, in which, however, the formula of sugar was erroneous, which I now request to correct according to the above statement.

—nt—

ON THE DECOMPOSITION OF BONE-EARTH BY ALKALINE CARBONATES.*

EXTRACT OF A LETTER FROM WAKENRODER TO LIEBIG.

The presence of phosphate of lime in the ashes of plants induced me again to make some experiments with regard to the decomposition of bone-earth by carbonate of potassa. Though the results of these experiments entirely corroborate the statements with reference to my former investigations concerning phosphate of lime, they may still be of some interest to you, as, on the present occasion, I have chiefly considered the combinations in which phosphoric acid exists in vegetable ashes. That bone-earth cannot contain any bibasic or b. phosphate of lime, will appear *à priori*, and yet the contrary is stated in a recently published work on pharmaceutical chemistry. This fact may easily be ascertained by dissolving either freshly-ignited bones with cornu cervi ust. alb. praep. of commerce in dilute cold nitric acid, and by treating the liquid obtained by nitrate of silver, neutralising it with ammonia. The pure egg-yellow precipitate clearly shows that 3 Ag+Po^{5} were contained in the acid liquid. To demonstrate, however, the presence of the tribasic or c. phosphoric acid in liquids containing free nitric acid by the ammonia, nitrate of silver is a method liable to induce mistakes.

If an aqueous solution of lapis infernalis be acidified, first by nitric acid and then neutralised by ammonia, no precipitate is thrown down, and on alternately acidifying and neutralising no change is noticed, except that it finally becomes very difficult completely to neutralise. If but little of the common or c. phosphate of soda were added to the solution, then on repeated solution of the precipitate, and renewed saturation of the liquid, the original yellow color of the tribasic phosphate of silver changes into a yellowish-white, particularly when the precipitate begins to be dissolved in caustic ammonia. By this, however, we may be induced to suppose that bibasic or b. phosphoric acid is present, and, indeed, a large quantity of the bibasic or b. phosphate of silver may be concealed by a little of the egg-yellow precipitate. The liquid containing phosphoric acid being finally rendered completely neutral, and reduced to a certain state of concentration, by stirring or standing for some time, deposits a crystalline yellow precipitate, and the liquid at the same time becomes of an acid reaction. This precipitate may be a double salt.

The phosphate of lime which remains after the preparation of phosphate of soda, on being boiled with carbonate of potassa or soda, undergoes still a considerable decomposition. Bone-earth, however, is not attacked by these alkaline carbonates, either on being

* Liebig's *Annalen der Chemie und Pharmacie*, August, 1844.

boiled or digested for a longer time in the cold. Yet traces of phosphate of lime are dissolved in the alkaline carbonates.

On being *calcined* with alkaline carbonates, bone-earth undergoes no inconsiderable decomposition, which is still but partially effected. This behaviour of bone-earth, which I noticed before, and stated in the directions published by myself, page 118, again excited my attention, it being undoubtedly important with reference to ascertaining the constituent or aggregate parts of the ashes of plants. On calcining two parts of pure carbonate of potassa with one part of bone ashes, the mixture either merely contracts or, at a stronger heat, it is fused. The fused mass, on cooling, has a compact fracture, presenting vesicles, its outer surface exhibiting crystalline scales; the mass almost appears to be a double salt. From the contracted powder cold water instantly extracts a great quantity of the tribasic phosphate of potassa; for ammonio-nitrate of silver, from the acidified liquid, throws down a copious egg-yellow precipitate, whereas the *fused mass*, even when triturated by cold water, it is attacked, and decomposed after some time. Hot water, however, immediately takes up a great quantity of the tribasic phosphate of potassa. One might think that in the bone phosphate of lime the proportion between acid and bases remaining unchanged, part of the phosphoric acid is replaced by carbonic acid. The vesicular appearance, however, of the fused mass shows that the carbonic acid escaped. Bone phosphate of lime, therefore, must be transformed either into a polybasic salt, or, when it originally was$=8CaO+3Po^5$, at least into $CaO+Po^5$.

It appears to me that phosphoric acid still presents many peculiarities, which do not agree with the view that it is a tribasic acid, unchangeable by heat and other influences. Remarkable it is, at all events, that on adding caustic soda to a solution of pyrophosphate or b. phosphate of soda, this is not changed; and yet it is known that on fusing with an alkaline carbonate, the tribasic c. phosphate of soda is produced. If the above-mentioned *fused* mixture is treated only with cold water, ammonio-nitrate of silver produces in the acidulated liquid an inconsiderable yellowish-white precipitate, whereas on boiling a precipitate is obtained, comporting itself exactly like that of common phosphate of soda.

—nt—

DETERMINATION OF THE ACIDS CONTAINED IN POTATOES.*

BY DR. FR. ILISCH.

The ashes of potatoes contain carbonates, which were found by Huschauer and myself in them in considerable quantities. These carbonates, however, could, on incineration, have only originated from salts composed of vegetable acids, the amount of hydrochloric acid found in the juice being manifestly too inconsiderable for us to admit that on being calcined with organic matter they were formed from metallic chlorides.

These circumstances induced me to examine the potato, with reference to its acid contents, and not only to find out the organic acids, but to extract likewise the inorganic acids from the bulbs of the plant. With this view I proceeded in the following manner:—

To extract in a pure state the acids contained in the bulbs of potatoes, they were bruised and the juice expressed. The freshly expressed juice obtained in that manner, its amylon having been removed by decantation, was boiled to separate the whole of its albumen. To the liquid filtered off from the albumen, basic acetate of lead was added until the juice, which was originally of an acid reaction, became feebly alkaline, and was then, together with the precipitate, suspended in it, first boiled and then filtered. The precipitate obtained in that manner, having been repeatedly washed with cold water, was mixed with distilled water and reduced to a pulpy mass, and then decomposed by sulphuretted hydrogen. To facilitate the separation of the precipitate formed of sulphuret of lead from the supernatant liquid, now containing the acids of the plant; previous to the admission of the current of sulphuretted hydrogen, a small quantity of alcohol was added to the lead precipitate, mixed with a little water, and the mixture having been completely saturated by sulphuretted hydrogen, was filtered. The filtered mass, previous to becoming entirely colorless, was again precipitated by acetate of lead, and the precipitate thrown down, with the same precautions, decomposed by sulphuretted hydrogen.

The filtered mass being evaporated by one-third was allowed to cool and divided in two parts.

One portion of these was then mixed with diluted milk of lime and filtered, by which the phosphoric acid was separated as phosphate of lime. Nitric acid was then added

* Liebig's *Annalen der Chemie und Pharmacie*, August, 1844.

to the filtered mass until it became of a feeble acid reaction, and afterwards treated by an excess of nitrate of silver. A small quantity of a white precipitate was thrown down, which was filtered off. This was insoluble in nitric acid, but soluble in caustic ammonia, and was, therefore, recognised as chloride of silver. The filtered mass, the chloride of silver having been separated, was now carefully saturated with ammonia, by which again a white voluminous precipitate was thrown down, which was easily soluble in free acids as well as in ammonia, and even in hot water. The precipitate having been repeatedly washed with cold water was placed on blotting-paper, and first dried between bricks, and afterwards at a temperature of 212°F.

On calcination in a procelain capsule
0·566 grammes of this salt left 0·350 Ag.
0·376 ,, ,, ,, 0·224—hence

0·942 grammes contained .... 0·574 Ag.

100 parts of this salt contain, therefore, 60·8 parts silver, which correspond to 64·4 parts oxide of silver. On combustion with oxide of copper 0·754 grammes of the same salt yielded 0·367 CO^2 and 0·093 HO, corresponding to 13·47 per cent. C and 1·366 per cent. H; hence, 100 parts of the salt contain 13·47 carbon, 1·36 hydrogen, 19·77 oxygen, 65·4 oxide of silver. By the determination of the silver the atomic weight of the salt appears to be 2211.

100 parts of the silversalt containing 13·47C, 1·36H, 19·77O, 65·4AgO; hence 2211 parts contain 296·4C=4eq.C, 29·6H =2eq.H, 435·5O=4eq.O, 1445·9AgO= 1eq.AgO.

The composition of the salt is, therefore, represented by the following formula:—

$$C^4H^2O^4 + Ag\ O.$$

To the other half of the filtered liquid was then added a solution of chloride of calcium and ammonia until it became of a basic reaction, by which the whole of the phosphate of lime was separated, and this latter substance on being removed by filtration, on applying heat a pulverulent crystalline substance was deposited, which was washed with cold water. The salt thus obtained was heated in an oil-bath at 392°F., which produced no apparent change.

On moistening the salt by sulphuric acid and calcining it, 0·173 grammes salt yielded 0·134SO^3, CaO, which in 100 parts shows 32·1 of lime. Hence the atomic weight of the salt of lime is=1109. 0·726 grammes salt gave on combustion with chromate of lead 0·722 CO^2 and 0·163 HO, corresponding to 27·4 per cent. C, and 2·4 per cent. H. Hence 100 parts of the salt contain 27·5 carbon, 2·4 hydrogen, 38·1 oxygen, 32·1 lime. 100 parts of the salt of lime containing 27·4G, 2·4H, 38·1O, 32·1CaO; hence 1109 contain 303·4C=4eq.C, 26·6H =2eq.H, 422·50=4eq.O, 355·9CaO=1eq. CaO; consequently the composition of the salt of lime, $C^4H^2O^4 + CaO$. Both the extracted salts coinciding in their reactions as well as in their composition with the salts of malic acid, it is evident that the organic acid found in potatoes is malic acid, in addition to which hydrochloric and phosphoric acids are met with.

No sulphuric acid having been found in the plant, it is just to suppose that the sulphates which were noticed in these acids were formed by incineration, at the expense of the sulphur contained in the albumen. The above analysis I made in the laboratory of Giessen, with the advantage of being advised by Professor Liebig.

—nt—

ASHES OF PINUS SYLVESTRIS.*

EXTRACT FROM A LETTER FROM WACKENRODER TO LIEBIG.

The ashes of the fruit of Pinus Sylvestris, deprived of their seeds, which are produced in the drying-kiln near Hanover, long ago excited the attention of my brother, and was several times analysed, lastly, with great care, by Mr. Raickoldt, under my own eyes, in my own laboratory. The great quantity of potassa may be accounted for by the great amount of granite occurring in the heaths of northern Germany. No trace of salts of soda could be detected in them, contrary to what, according to the analyses of Berthier and Hertwig, made with fir was to be anticipated.

On testing for soda, to make use of the antimoniate of potassa, in the manner indicated by myself, must never be omitted in examining vegetable ashes. The alum found in the ashes of the pinus was considerable in quantity, and could not, therefore, be supposed to have originated from the materials of the furnace, which being made of iron plates, is destined to be heated by the fruits deprived of their seeds to effect the roasting. The examination of borings of the trunks of Pinus Sylvestris, of the Thüringer forest could, till now, give no satisfactory results to decide upon the presence of alum in these ashes, because in the presence of phosphates, it is always difficult to discover small quantities of alum. Only by employing larger quantities of the substances to be

* *Vide* Liebig's *Annalen*, vol. xlvi., p. 106.

examined errors may be avoided. That the quantity of phosphoric acid in the ashes of the pinus is so considerable, is a phenomenon highly interesting in many respects.

The most important fact, and, as it seems, overlooked hitherto, is, that the phosphate of lime of the ashes may be decomposed by carbonate of potassa. If cold water is thrown on ashes produced the preceding autumn, even after 24 hours, no trace of a phosphate is extracted. On boiling the water, however, or on applying only a gentle heat, a large quantity of tribasic phosphate of potassa is produced. This may, perhaps, be formed of the phosphate of iron of the ashes; yet the phosphate of lime must likewise contribute to it. And the following striking fact was noticed, that when, with the view of completing the analysis, the ashes were again feebly calcined, cold water could extract a large quantity of the tribasic phosphate of potassa in the same manner as it does from the bone-earth calcined with the carbonate of potassa. If the ashes are entirely deprived of soluble substances by hot water, then no inconsiderable quantity of phosporic acid, being combined with potassa, remains in the liquid. Yet, of course, on specifying the constituent parts of these ashes so rich in lime, this portion of the phosphoric acid must be considered only as phosphate of lime, viz., as bone-earth. I hope to be enabled to communicate a complete analysis of these ashes on an early occasion. The important and interesting investigations of ashes of plants may, as you have already stated, properly be classed among the more difficult operations of analytical chemistry. —nt.—

ANALYSIS OF THE CRYSTALLINE NICKEL-GLANCE OF SCHLADMING.*

BY FR. PLESS.

The nickelglance of Schladming was recently investigated by Löwe. The composition which then resulted was not in accordance with that of the Swedish nickelglance examined on a former occasion by Pfaff and Berzelius, and with that of Haueisen, near Lobenstein, investigated by Rammelsberg. The specific gravity of the species examined by Löwe, was from 0·7 to 0·8 higher than that of the others; it was, therefore, not without interest to examine again the nickelglance of Schladming. The mineral, which was the subject of our researches came from the hands of the Counsellor de Gersdorff himself, the proprietor of the Schladming mine; it was given to me by Prof. Redtenbacher, in whose laboratory I made the analysis.

One portion of the mineral consisted of compact nickelglance, and partly of groups of crystals of the same body, occurring together with kalkspath and quartz. Another portion consisted of long crystals and small compact fragments. The kalkspath having been separated by a diluted acid from the sample presenting the mineral in its compact state, long crystals could be removed from all parts.

I endeavored to employ, at least for one analysis merely, manifestly crystallised pieces, to avoid the admixture of any arsenical pyrites with which it may happen to occur. The crystals were the combination of the hexahedron and the octahedron, the pentagonal dodecahedron, and its combination with octahedron. Several of the crystals were less distinct, for the first analysis, however, were carefully picked out only mostly small specimens in which the said forms would be distinguished with certainty. Their specific gravity taken at a temperature of 52° F., having deducted the amount of quartz contained was = 6·64.

For analysis I. the mineral was dissolved in aqua regia till the sulphur was completely oxidised. The sulphuric acid was precipitated by chloride of barium, and the arsenic by sulphuretted hydrogen; the amount of the latter substance being determined on deducting the sulphur; the iron was thrown down by succinate of ammonia, the nickel by caustic potassa, and the cobalt by sulphuret of cobalt. The sulphuret of cobalt was oxidised again, and the oxide of cobalt reduced to the metallic state by hydrogen, and weighed.

The analysis II., according to the method employed by Berzelius and H. Rose, in analysing mixtures of metallic sulphurets, was made by chlorine gas. Notwithstanding that chlorine gas was passed through for several days, and rather a strong heat applied at the same time, yet, after the apparatus was dismounted, in the interior of the semifused mass a portion of the mineral was contained in the glass button in an unchanged state. The decomposed portion was employed in analysis II., and the crystals which remained entirely unaltered in analysis III., which for the rest were both executed in the same manner as analysis I. The crystals of analyses II. and III. were less completely developed. The small quantity of oxide of cobalt was immediately weighed while still oxide of cobalt, and not first reduced by

* Liebig's *Annalen der Chemie und Pharmacie*, August, 1844.

hydrogen. The arsenic, in analysis III., was determined by the loss, though it was completely removed from the liquid by sulphuretted hydrogen.

The analyses yielded the following results:—

I. 1·880 gram. mineral gave 2·225 gram. sulphate of baryta, 0·7332 gram. arsenic, 0·4675 gram. oxide of nickel, 0·2652 gram. metallic cobalt, 0·3015 gram. oxide of iron, and 0·002 gram. quartz.

II. 1·209 gram. mineral gave 1·404 gram. sulphate of baryta, 0·4821 gram. arsenic, 0·4285 gram. oxide of nickel, 0·0127 gram. oxide of cobalt, and 0·261 gram. oxide of iron.

III. 0·783 grams. ubstance (on deduction of 0·0015 gram. quartz) gave 0·9594 gram. sulphate of baryta, 0·1377 gram. oxide of iron, 0·2847 gram. oxide of nickel, and 0·0287 gram. oxide of cobalt.

These analyses correspond to the following per centage:—

	I.	II.	III.
Sulphur ..	16·35	16·11	16·91
Arsenic ..	39·04	39·88	39·40
Nickel ..	19·59	27·90	28·62
Cobalt ..	14·12	0·83	2·88
Iron	11·13	14·97	12·19
	100·23	99·69	100·00

If in these three analyses the equivalents of cobalt and iron, which are isomorphous with nickel, are together with that latter body expressed under the head of nickel, the following is the result:—

	I.	II.		
Sulphur....	16·35	16·11	16·91	16·27
Arsenic	39·04	39·88	39·40	38·99
Nickel	45·87	45·04	44·79	44·74
				100·00

If hence we deduce the most simple proportion in atoms, we obtain:—

		In 100 parts	
		calculated	found
3 at. Nickel =	1109·0	45·24	44·74
2 ,, Sulphur =	402·3	16·41	16·27
2 ,, Arsenic =	940·1	38·35	38·99
Atomic weight..	2451·4	100·00	100·00

The elements Ni^3, S^2, As^2, may be arranged in two different manners; the investigated mineral may have the formula $Ni\,S^2 + 2\,(Ni\,As)$, or the formula : $2\,Ni\,S + Ni\,As^2$.

The behavior of the mineral in the glass vessel, in which, besides sulphuret of arsenic, metallic arsenic is sublimed, speaks for the latter formula. If the combination Ni As would be contained in the mineral, then, as in the case of copper nickel, no arsenical sublimate could be formed; but this takes place with the arsenic nickel $Ni\,As^2$. On comparing the formula of the nickel-glance of Loos: $Ni\,S^2 + Ni\,As^2$, with the preceding $= 2\,Ni\,S + Ni\,As^2$, we find in the first member one atom of nickel, or one atom of the isomorphous iron cobalt too much.

Mr. Lerch, deriving the nickel-glance of Schladming from the same source, investigated it last year, which, however, was not so distinctly crystallised as to warrant its purity. The analyses were made by aqua regia in the manner stated above. The specific gravity of the nickel-glance of the first analysis was 6·691.

Sulphur	13·74	15·86
Arsenic	49·17	45·04
Nickel	23·44	4·86
Cobalt	0·29	traces
Iron	13·93	33·12
Bismuth	—	1·04
	100·57	99·92

Neither of the two analyses lead to a rational formula, even by deducting from the second the bismuth as sulphuret of bismuth; the analysed minerals seem, therefore, to have merely been mixtures.

—nt—

INVESTIGATIONS CONCERNING THE PRODUCTS RESULTING FROM THE ACTION OF IODINE AND CHLORINE AND AMMONIA.*

BY M. A. BINEAU.

The difficulties which the handling of iodide, *i. e.* nitrogen, presents, have hitherto prevented the determination, by means of analysis, of its true nature. In the absence of positive experimental data, conjectures have served as bases for two very different ideas, presented successively, with regard to its composition. According to the oldest opinion, emanating from M. Colin, nitrogen and iodine would be the elements of the substance, and would be combined in the proportion of one volume of the former to three volumes of the latter. This opinion has recently been disputed by MM. Millon and Marchand. Seeing hydrogen appear in the state of hydriodate of ammonia among the products of the detonation of the pretended iodide of nitrogen, that it necessarily contained nitrogen, and regarding it as an *iodide of amide*, whose elementary composition would be represented, in aëriform volumes, by 1 iodine, 1 nitrogen, and 2

* *Comptes Rendus*, No. 16, Oct. 14, 1841.

hydrogen, it will be seen that the analytical proofs justify neither of these views. The substance to be analysed not being capable of being weighed, I took, for each operation, an undetermined quantity, and I endeavored to estimate the relative quantities of its elements.

A remark of Serullas might, if profoundly studied, put us in the way of the truth; indeed, that chemist noticed the constant production of free hydriodic acid after the decomposition of *iodide of nitrogen* by hydrosulphuric acid. Not having appreciated the quantity of this free hydriodic acid, he attributed its origin to a small quantity of iodine remaining in the state of simple mixture with the iodide. This would perfectly accord with the idea of an *iodide of amide*. But the proportion of iodine converted in this case into hydracid is far from insignificant; it is not less than the quantity of that element which passes to the state of neutral hydriodate, even when the matter submitted to experiment, having been prepared with a great excess of ammonia, could not be accompanied by uncombined iodine. I have found the proof of this in the experiments which I have described.

It is evident, besides, that the composition lately proposed cannot be rejected, as well as that formerly admitted, and that the following must be substituted for it:—

Nitrogen.....	1 vol. of vapor,	or else a triple equivalent	175*	or 5·20
Iodine.....	2 vols.	2 equivalents.....	3·160	or 94·43
Hydrogen	1 vol.	1 equivalent	12·5	or 0·37
			3347·5	100·00

The atomic formula of NI^2H, or $N^2I^4H^2$, which represents this composition, is adapted to the following three systematic forms:—

$$NH+I^2\ ;\ N\tfrac{1}{3}H+N\tfrac{2}{3}I^2\ ;\ \text{or,}\ N^2H^6+2N^2I^6\ ;\ \begin{matrix}N^2H^2\\ I^4\end{matrix}$$

The first is the symbol of the theory which would consider the deteriorating product as a combination of iodine and of the hypothetical compound called *imide* by M. Laurent. Will this radical be admitted, either as a product which should be developed in the isolated state in the hands of chemists, or only as a creation of the imagination destined to facilitate the enunciation of the composition of certain bodies? Then, the hydrogeneous iodide of nitrogen would take the name of *iodide of imide*. It would be desirable, however, that the denomination of *imide* were replaced by another whose sound would be less similar to *amide*.

The second formula, to which the name of ammoniacal iodide of nitrogen will correspond, based on that of ammoniacal nitroguret of potassium, represents a compound formed of 2 atoms of iodide of nitrogen and 1 atom of ammonia, a compound analogous to many other admitted combinations.

Finally, the third formula presents the substance in question as ammonia in which two-thirds of the hydrogen is substituted by an equivalent quantity of iodine. The formula N^2 (H^2, I^4) would be nearly to the same effect. M. Laurent's nomenclature, applied to this case of substitution, would furnish the name of *iodammoniaquese*. That of iodhydroguret of nitrogen, although less significant, since it does not indicate the proportion of the constituent elements, might be preferable to many chemists, as being more in harmony with the rules of ordinary nomenclature.

CHLORIDE OF NITROGEN.

Many chemists appear to be convinced of the presence of hydrogen in chloride of nitrogen as well as in the ioduretted combination; one of them even believing that he has established decisive experimental proofs of the similitude of the composition of these two products, it seemed to me useful to extend to the chloride the investigations which had unveiled to me the true nature of the compound formed by iodine. I have successively tried the employment of arsenious acid, then of sulphuretted hydrogen, and, finally, of mercury.

Chloride of nitrogen, after being agitated with an excess of arsenious acid in solution in water, was converted into hydrochloric acid, ammonia and free nitrogen, which was gradually disengaged. In the liquor thus obtained, the hydrogen yielding to the elements of the chloride of nitrogen was estimated by a means similar to that used for the iodhydroguret. The chlorine was esti-

* Science is now enriched with a principle generally adopted, to which should be attached, it seems to me, my views on the subject of the equivalent of nitrogen (*Annales de Chimie*, 2e série, t. xlvii., p. 241). We admit, indeed, for certain compound bodies, what may be called condensed equivalents, such as, for example, the quantity $C^{24}\ H^{10}\ O^{11}$ of citric acid, which is regarded as saturating 3 equivalents of base, and which, consequently, represents a triple equivalent of acid. Why not apply to nitrogen analogous considerations.

mated in the state of chloride of silver. Finally, to ascertain the proportion of ammonia, I employed a process, whose accuracy I have proved by several trials, and which alone succeeded for the determination of very small quantities of these alkalies. A portion of the liquor was submitted to distillation with lime in an apparatus in which volatilised ammonia was appreciated according to the acid which it neutralised.

I was led to the following results, with 10 cubic centimetres of liquor :—

Hydrogen yields*	0gr·00063
Chlorine†	0·0154
Nitrogen in the state of ammonia‡	0·00089
Whence is deduced—	
Hydrogen acidifying chlorine ..	0·00044
Hydrogen existing in ammonia..	0·00019
Total	0·00063

The identity of this last number with the first, shows that the whole of the hydrogen found in the products of the destruction of chloride of nitrogen is foreign to its constitution : the nitrogen and chlorine are its only element.

Thinking the reaction of hydrosulphuric acid would be sufficiently powerful to disengage only unimportant traces of nitrogen, I endeavored to apply the determination of the proportion of the nitrogen to the chlorine.

40 cubic centimetres of the liquid obtained by agitating chloride of nitrogen with water, saturated with hydrosulphuric acid gas, gave, after the expulsion of the excess of this gas, 0 gr. 276 of chloride of silver, denoting 0·0171 of chlorine in 10 cubic centimetres.

Moreover, by experiments similar to those which have already been mentioned, I obtained the following quantities of nitrogen :—

milligrammes.			
12·50 in 60c.c.·0	or 2·09	in 10	cubic centimetres.
4·19 in 20 c.c. ·0	or 2·10	,,	,,
5·87 30 c.c. ·0	1·98	,,	,,
3·86 20 c.c. ·0	1·93	,,	,,
10·53 52 c.c. ·0	2·01	,,	,,
Mean	2·09	,,	,,

whence is deduced for the proportion of the chlorine to the nitrogen :—

$$\frac{1}{0\cdot 0}\frac{0\cdot 17}{0\cdot 02}\frac{1}{0\cdot 2} = 8\cdot 5$$

A few bubbles of nitrogen are developed during the treatment by hydrosulphuric acid.

The experimental data furnish an excess of chlorine. The analysed matter was abundantly washed with distilled water. It is possible, nevertheless, that it retains the chlorine in solution. Be it as it may, the results of the analysis allow of no uncertainty as to the atomic constitution of the substance.

After having ascertained the dissimilarity of composition of the fulminating nitrogenous compounds of chlorine and iodine, and wishing to analyse the ioduretted product formed by double decomposition, according to the directions of M. Millon, and to prepare it, I caused chloride of nitrogen to act on a very dilute solution of iodide of potassium. But, owing, apparently, to an unexpected difference of circumstances, the brown powder which I obtained was nothing more than

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* 150 cubic centimetres of arsenious acid, of the strength called normal by M. Gay-Lussac, were added to the chloride of nitrogen, and formed, with the product which covered it, a volume of 184 cubic centimetres ; there was, therefore, nearly 8c.c. 15 of arsenious solution in 10 cubic centimetres of liquor. 60 cubic centimetres of this liquor destroyed 6c.c.·79 of normal chloruretted solution, or 1c.c.·13 per 10 cubic centimetres, the difference 8·15—1·13 or 7c.c.·02 indicates, therefore, the arsenious acid consumed by the reaction of the chloride of nitrogen, and fixes the weight of the hydrogen yielded, at $7\cdot 02 \times 0^{mm}\cdot 0895 = 0^{mm}\cdot 628$.

† 25 cubic centimetres of liquor gave 0gr. ·156 of chloride of silver, containing ·0385 of chlorine, or 0·0154 per 10 cubic centimetres. This result was confirmed by another obtained by means of nitrate of silver of known strength.

‡ Liquor treated by lime ..

	1st Experiment.	2nd Experiment.
Liquor treated by lime ..	30c.c.·00	30c.c.·00
Acid of known strength, into which the ammonia was received	5c.c.·72	6c.c.·28

It contained, per litre 11gr·275 of sedecihydrated hydrochloric acid, namely, the value in grammes of $\frac{1}{200}$ of an equivalent. Consequently, each cubic centimetre should saturate a quantity of ammonia containing $\frac{17\cdot 5}{200}$ of a milligramme or $0^{mm}\cdot 875$ of nitrogen. Lime-water, to complete the neutralisation of the acid which had absorbed the ammonia 3c.c.·86 4c.c.·78 (10 cubic centimetres of acid of known strength, require for their saturation 14c.c.·7 of this lime-water). The acid neutralised by the ammonia is therefore—

$$5\cdot 72 - \frac{3}{1}\cdot\frac{86}{47} = 3 \text{ c.c. } 09 \quad 3 \text{ c.c. } 03$$

and the nitrogen of the ammonia per 10 centimetres of liquor—

$$\frac{3\cdot 09}{5} \times 0\cdot 875 = 0\text{mm } 90 \quad 0\cdot 885$$

odine. At the same time as it was formed, nitrogen was disengaged.

To recapitulate,—

1st. The composition of the product which was first called iodide of nitrogen, and, more recently, iodide of amide, is at variance with both of these denominations. It is represented by ammonia, in which two-thirds of the hydrogen are replaced by an equivalent quantity of iodine.

2nd. With the support of new proofs, I can only persist in admitting the proportion of 3 equivalents of ammonia to 2 equivalents of iodine, in the liquid resulting from the absorption of ammoniacal gas by iodine.

3rd. The constitution of chloride of nitrogen has wrongly been considered analogous to that of the hydriodide. The primitive opinion should be maintained. Chloride of nitrogen is composed only of nitrogen and chlorine, combined in the proportion of 1 volume of the first to 3 volumes of the second.

To the numerous comparisons which have been made between ammonia and olefiant gas, may be added another, founded on the nature of the products of their decomposition by chlorine and iodine. We see both of them, indeed, give with chlorine, by way of substitution, binary compounds which are totally eliminated, whilst, with iodine, the metalepsy, always less complete, gives rise only to ternary combinations, in which a portion of the hydrogen remains invincibly engaged.

ON THE ALTERATIONS AND ADULTERATIONS OF ALIMENTARY SUBSTANCES.*

BY A. CHEVALLIER.

The following petition was addressed by M. Chevallier to the Chamber of Peers and the Chamber of Deputies; but the Session has terminated without its having been made the subject of a report as to the measures to be taken for the prevention of the frauds specified in it:—

TO THE MEMBERS OF THE CHAMBER OF PEERS, AND TO THE MEMBERS OF THE CHAMBER OF DEPUTIES.

Gentlemen—Before determining to avail myself of the right of petition, which belongs to every citizen, and before resolving on disturbing your numerous and important occupations, I have considered it my duty to ask myself whether the abuses which I think it my duty to lay before you were serious—whether they were of a nature to injure commerce—whether they might compromise the life and health of mankind—finally, whether they deserve special attention.

The serious examination which I have made of everything relating to the adulteration of commercial and alimentary substances, has shown me that the necessity for a prompt and severe repression of these frauds should fix your attention. Indeed, the adulteration of commercial products is so injurious to our foreign commerce, since, in consequence of the succession of frauds which are practised in the preparation and manipulation of various products, these products are rejected at foreign places of commerce, whence it results that our artizans lose their work, and our merchants their reputation, and that they do not derive the benefit they might hope for from the practice of their profession if it were legitimately exercised.

In the second place, the aliments, drinks and condiments, destined to sustain the life of man, and to supply the wants of their daily existence, are the subjects of frauds which may, in a great number of cases, injure the health of those who use them, but which in all cases have for their object the substitution of a cheaper for a more expensive product.

According to this explanation, commercial frauds, and the adulterations of alimentary and condimentary substances being in the highest degree injurious to the health and interests of the population, and to the prosperity of commerce, we think that it becomes indispensable that a law be made to prohibit existing frauds, and to prevent those which are daily springing up.

In our opinion, in such a law, the simple adulteration of a substance by a product of less value should be considered as a daring theft which we do not notice, and which is daily renewed, because we are on our guard against the ordinary theft, whilst no precaution is taken against a tradesman who may cheat every day. This deception, when it is practised on the middle classes, is prejudicial to them, but it is much more so to the workmen, since those who exercise it deprive them by fraud of part of their laboriously-earned wages.

In some cases, applicable only to the healing art, adulterators are, in my opinion, guilty of the crime of *voluntary homicide*, in substituting inert for active products which might determine a revulsion by which the patient might be saved. We will mention, as an example, the adulteration of the farina of mustard with the farina of the cakes arising from the manufacture of oil of colza.

We will leave to men of high merit, and who have recently given their opinion

* *Annales d'Hygiène publique*, October, 8 44.

concerning commercial frauds, and the *marques des fabriques*, the task of informing you what are the commercial frauds which injure the prosperity of our commerce and our industry; we will only make known to you that which we have observed relative to the sale of alimentary substances, drinks and condiments—substances which are indispensable, and to which we wish to call your attention.

The frauds of alimentary substances have been proved as follows:—

I.—OF FLOUR DESTINED FOR THE PREPARATION OF BREAD.

It has been ascertained that the flours sold, as being of good quality, were altered, and that they had undergone an acid fermentation; that others were adulterated with potato-fecula, others with farina prepared with legumens bitten by insects, and which could not be sold without being altered in form; powder of alabaster has been mixed with flour; the fraud has even been carried to such a point that mineral substances, reduced to the state of powder, have been offered *in the market* in the Department of the Seine, to be mixed with flour.

We do not think that the addition of fecula to farina can be injurious to health, but it is a robbery on the part of the vender against the baker; for fecula introduced into farina, and made into bread, *as farina is*, does not absorb water, and does not yield so much bread as farina; it is a robbery against the consumer, if bread prepared with farina mixed with fecula, and which contains less gluten, is, as many scientific men think, less nutritious; it is a robbery, especially injurious to the workmen, who cannot, like the rich, like men in easy circumstances, eat as much meat as he will.

We are convinced that a white, savory, and wholesome bread might be prepared with fecula and wheat flour in the proportion of 25 to 50 per cent. of farina to from 50 to 75 of fecula, which might be sold at a lower price than bread made of pure wheat-flour, but the composition of this bread should be notified by the maker and sold at its real value.

II.—OF BREAD.

The frauds in this article of food are happily much more rare in France than in a neighboring country (Belgium), where the sulphates of copper and zinc are added to the paste, in consequence of the erroneous idea that the addition of these salts gives rise to a more considerable production of bread.* This culpable adulteration was, for some time, practised in France, but it has been totally abandoned for some years.

It is a positive fact that *baked potatoes* are used in the preparation of bread, and that a patent has recently been sold for the application already made of this mode of panification.

We do not think that the Administration can forbid him who prepares bread for his own use to introduce into it any substances he pleases; but we think that the Administration should not tolerate in Paris the introduction, by the baker, of any substance whatever into the bread sold for pubic consumption; indeed, in the capital bread is taxed, and the tax is based *on the employment by the manufacturer of pure farinas, and not of other substances, whatever they may be, even if superior to farina, which is not the case.*

If a baker has discovered a process, or if a process of manufacturing bread be communicated to him, which is economical, he should not make use of it except with the authority of the Administration, which should judge of the wholesomeness of this process, and which must then study the public interest.

This process, put in practice, might have the advantage of reducing the price of bread, and it is known, according to M. Chabrol, *that the diminution of* 10 *centimes per kilogramme of bread is of high importance* to the poorer classes inhabiting the capital. Indeed, that learned Minister has proved *that by admitting that there exist in Paris* 500,000 *consumers of bread of the poorer class,* 5 *centimes per day increase in their expenses in the purchase of bread would give, per annum, a sum of* 9,125,000 *francs.*

If we suppose that by economical and wholesome processes, a diminution of 10 centimes per kilogramme of bread could be obtained, *this aliment being as* nutritive, an annual saving of 9,125,000 francs to the poorer classes would be effected.

The proportion of water contained in bread sold for consumption merits, we think, all the attention of the administration; indeed, a loaf of 2 kilogrammes, which will weigh only this weight, may represent more nutritive matter than a loaf in which the 2 kilogrammes are complete; in the one, the water has been evaporated by baking; in the other, the water has not been able to volatilise, and adds to the weight.

* The Court of Appeal at Brussels, M. Espital, president, has confirmed the sentence which condemned a baker, named Pennincky, to two years' imprisonment, and a fine of 200 florins of the Low Countries, and deprived him of his *right of patent*, for having introduced sulphate of copper into the bread which he prepared.

The legal exercise of the trade of baker in Paris deserves the attention of the authorities, for it is difficult; indeed, he who exercises it is always suspected, even when he is honest; the probity of the baker is not believed, and he has always been represented as committing fraud. It is extraordinary, that when insurrection disturbed the streets, the bakers did not fall victims to a reputation which some of them may merit, but which should not be imputed to the greater number of them.

A just and severe law should severely punish the man who, charged with furnishing us with an indispensable aliment, wilfully deceives us; but this law should be based on regular studies and practical facts; its execution should also be made in an ostensible manner. Thus, a profession would be relieved, so that an honest man who exercises it may not run the same risks as one who enriches himself by daily delinquencies, an unfortunate result, since it puts the honest man and the rogue on the same level, also, the honest man is injured by the rogue, who reproaches him with what he calls his *ingenuity*.

III. OF MEAT.

This aliment is sometimes sold of false weight, and at other times it is spoiled when put up for sale. Our observations on the sale of spoiled meat have most frequently regarded meats which have been cooked.

IV. OF MILK.

Nine-tenths of the milk sold in Paris is diluted with one-third of water, to which, for some time, a little cassonade or caramel has been added; finally, bicarbonate of soda to prevent the milk from turning.

Some years ago, farina, fecula, rice-flour, and gum, were employed for adulterating milk: it appears that these substances have been abandoned by adulterators.

The adulteration of milk in Paris would be difficult to repress, because the poorer classes are in the habit of paying for milk less than its value. It would be indispensable, before seeking to suppress this fraud, to make the public comprehend that they would be obliged to pay one-third more for milk than is paid at present, and that it is obtained at a low price only because it contains at least one-third of water and only two-thirds of milk. The population have been wrongfully disgusted by the publication of statements that milk has been prepared with the brain of animals, and especially with that of horses killed at Montfaucon; all the investigations made with the view of ascertaining the truth of this statement have demonstrated the falsity of a fact advanced it is not known with what object.

V. OF BEER.

The beer sold in Paris should be made only with the seeds of cereals, properly prepared, and with hops. It is known, however, that a portion of this drink is the result of an operation into which enters, instead of malted barley, syrup of fecula, which sometimes contain a salt of copper, and that the hop is sometimes replaced by leaves of box and menianthe.

It would be, in my opinion, easy to suppress these frauds, since the brewers who commit them are liable in a fiscal point of view, by persons employed in the Administration, who might give useful information concerning these unwholesome preparations.*

VI. OF CULINARY SALT.

Common salt—that indispensable condiment which enters into the preparation of our food—has been the subject of numerous frauds, which have been partially suppressed, but not totally.†

Salt has been mixed:—1st, with crude plaster (plaster-stone reduced to powder), and this adulteration was so great in Paris that an establishment was fitted up by a manufacturer for the pulverisation of this stone, which was afterwards sold in commerce under the name of *powder to be mixed with salt;* 2nd, with granite reduced to powder; 3rd, with salts of vareeh and salts of every kind arising from various manufactures of chemical products. It must be remembered that, in 1827, an epidemic, which attacked more than 400 persons, was caused by culinary salt sold in the department of Marne. This salt was subjected to several experiments, and it was discovered that it contained iodides and arsenic. It was not known at first to what to attribute the presence of arsenic in this salt; but it was learned some time afterwards that this salt had given rise to these accidents arising from a manufactory in which salts of vareeh were refined, destined to be mixed with refined common salt. Similar salt was sold in Paris, and rendered ill a family named Pymor. This salt caused swelling of the face, pains in the head, ardent thirst, in-

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* We are assured that in France, as in England, substances of extreme activity are employed for giving bitterness to beer! but hitherto the truth of this assertion has not been demonstrated to us.

† The endeavors made by the orders of the Prefect of Police to suppress this fraud have been immense; the members of the Council of Health have submitted to chemical analysis more than 4,000 samples of salt, and yet it is still adulterated.

flammatio amygdalæ of the *a*, and intolerable pains in the course of the stomach and intestines, followed by a diarrhœal flux, almost always sanguinolent.

The mixture of salts arising from manufactures with alimentary salt, may present very great danger. The *Presse* of December 17, 1843, states that, at the Hague, more than eighty persons were poisoned by using, for seasoning their food, salt procured from a manufactory at which it was sold for a very low price. Experiments demonstrated that this salt contained an arsenical preparation.* (*See* THE CHEMIST, p. 186, vol. v.)

White salt has been mixed with salts of varech and with the salt resulting from the extraction of saltpetre. Some of these salts contained a compound of copper arising from the boilers in which these products were evaporated. *We have seen* white salt destined for the soldiers; this salt was salt of varech, which was reduced to small grains by passing through a sieve of copper-wire, covered with verdigris.

VII. OF FECULA.

Fecula is mixed with carbonate of lime. Quite recently we have found some which was mixed with alabaster, arising from the manufacture of pendulums and various objects of art. The proportions of powder of alabaster, added to fecula, have been ascertained to be from six to seven per cent. This fecula was, however, contained in bags bearing a printed label as follows:—"Potato-fecula, purified for alimentary use and for children."†

VIII. OF SUGAR.

Sugar has been adulterated with sugar of fecula, earthy matter and sugar of milk. These substances are not, it is true, injurious to health; but they are cheaper than the sugar for which they are substituted.‡

IX. OF CHOCOLATE.

The chocolate sold in Paris is often mixed with fecula, farinas and sometimes with an inert powder prepared by bruising cocoa-nut shells. These substances are inert it is true; but we should not buy the chocolate containing them if we were informed of the fact by the label.

A fact which proves the adulteration of chocolate is that this product is sold below the market price; however, the manufacturer should have this profit on the sale.*

X. OF HONEY.

Honey is adulterated with fecula and syrup of fecula. We have seen honey prepared with syrup of fecula, which had become solid in the barrel, so that the grocer who had bought it did not know what to do with the product, which, owing to its solidity, could not be sold to the public.

XI. OF COLORED SWEETMEATS.

Colored sweetmeats, bonbons, and lozenges have long been the subjects of serious apprehensions to the Government; saccharine matters intended for children have been colored with arsenite of copper, with gamboge, with vermilion, with blue ashes, with chromate of lead, and with red lead; liquors owe their green color to a salt of copper. The limited number of manufacturers has enabled the Government to take measures which have been effectual. These measures consist in causing the shops and manufactories, where these sweetmeats are prepared, to be visited, and in causing the substances employed to be analysed by members of the Council of Health of the Department of the Seine. These members, besides these visits, give, throughout the year, gratuitous advice to the confectioners who wish to employ new coloring matters. It is in consequence of this measure that we have known that a color manufacturer sold to a confectioner for factitious ultramarine, an

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* A letter from M. Wrydag Zinem, pharmacien at the Hague, has since informed us that the salt sold at the Hague had been mixed with arsenic by the grocer's servant, with the object of driving away the customers from his master's shop, in order that he might have the less work to do.

† The Administration having knowledge of this fact, because Sieur R., manufacturer of objects of alabaster, had offered his powder at various establishments, to merchants of good faith, the Prefect of Police ordered investigations on the subject.

‡ This fraud had attained such a height, that enormous masses of ice were manufactured to be mixed with sugar.

* The following statement was made by a manufacturer who sold chocolate at 70 centimes the ½ kilogramme, and from whom a sample of chocolate of inferior quality was taken:—"*I do not think that a worse quality of chocolate could be manufactured. This manufacture is disgraceful to commerce, and I make it only in my own defence and to sustain competition. I have but one regret, which is, that the Government has not the power to oppose this pitiful manufacture, which consists, simply, of making chocolate with the last residues of cocoa.* (He might have added, with the addition of fecula.) *As we descend in the quality of bread, to preparing it with bran for animals.*"

inoffensive blue color, a poisonous mixture, formed of 60 per cent. of ultramarine and 40 per cent. of blue ashes, carbonate of copper.

XII. OF SALAD OIL.

Olive oil is daily adulterated with an oil known by the names of white oil and oil of carnations, which is of less value, and whose quality is not the same.

To give mixed oils the appearance of olive oil, solid fatty matters are often added, which give them the appearance of olive oil rendered concrete by cold.

XIII. OF CIDER.

The cider sold in Paris is rarely pure; fermented liquors prepared with sugar of fecula, cassonade, and vinegar, are substituted for it; every kind of it is prepared with dry fruits, or else it is prepared in vessels which render it injurious: we have seen cider containing lead give rise to more or less serious symptoms.

We have seen sold, and even in the interior of the casernes, *under the name of cider*, liquids which merited a serious attention on the part of the military authorities. By the sale of these liquids, the soldier is, in the first place, deceived in the value of the product, and is also liable to be rendered more or less dangerously ill: this so-called cider contains a small quantity of a salt of copper.

XIV. OF COFFEE.

Coffee, which is a necessary morning aliment to a great number of the poorer classes, is often the subject of numerous frauds. Coffees which have been thrown into the sea are taken up, worked, and then sold in commerce with coffees of good quality. Coffee of good quality, when ground, is adulterated with—1st, exhausted coffee, which has been collected and dried; 2nd, with powders, obtained by torrefying various products, roots of chicory, beet-root, carrot, the seeds of peas, pointed peas, rye, &c. &c. All these products are not injurious to health, but they are sold for that which they are not, and as substitutes for a product of greater value. There is no chicory which has not been the subject of fraud; this product, intended to be mixed with coffee, has been adulterated in its turn. Thus, there is sold in commerce as chiefly coffee—1st, a product resulting from a mixture of exhausted coffee and torrefied bread; 2nd, a product resulting from a mixture of chicory, coffee, and animal charcoal, arising from the decoloration of sugars, a *residue of the refineries*. We will here call to mind that, in the course of legal proceedings carried on between the Sieurs L. and D., it was proved that one of the brothers, L., a merchant, had come to Paris to collect various residues: the powder of semoule, and the residue of vermicelli, which should be dyed and mixed with chicory coffee, but that having ascertained that this product did not present the advantage which he had hoped for, he put himself in connexion with the lemonade boys, and for two months employed a man and a cart to collect all the coffee grounds which had been preserved at his request.

XV. OF WINES.

The wines sold at Paris, by retail, are, in general, wines produced by the mixture of several crude products. But this mixture is not a fraud; the fraud practised consists in mixing with the southern wines, which contain a great quantity of alcohol, water, acidulated either with vinegar or with tartaric acid; sometimes, instead of water, dry fruits are macerated, and the liquor added, and these mixtures are colored with juices prepared with different matters, and especially with elderberries. Formerly, the wine which became sour was saturated and sweetened with oxide of lead, litharge, according to the process of Martin le Bavarois; now this dangerous saturation is almost abandoned: we had an opportunity of noticing it, however, some years ago, at Compiégne; several soldiers of the camp were taken ill; the cause of their illness was investigated, and it was ascertained that this cause was attributable to the use of a green wine, which had been sweetened with acetate of lead; the vintner, who had bought from a druggist the acetate which he introduced into his wine, was brought before the tribunal, and convicted.

Wine is also, in some cases, mixed with alum, with the view of rendering it clearer and more limpid.*

XVI. OF BRANDIES.

The brandies sold by retail are most com-

* It should be called to mind—1st. That some months ago, the Sieur R. proceeded before the tribunals against a company against the sale of a process, by aid of which a portion of wine was doubled without increase of price. 2nd. That two musicians, dealers in wines, were condemned to three months' imprisonment, and to a fine of 200 francs by the 7th Chamber, for having manufactured with water, vinegar, southern wine, and campeachy wood, a liquid which they had sold as wine. We have just detected in wines the presence of a salt of copper, arising, in our opinion, from alcohol containing a salt of copper having been added to it.

monly mixed with alcohol of fecula and water, the whole colored by caramel; sometimes the brandies, owing to the impurity of the alcohol, and in consequence of negligence of the distillatory vessels, contain salts of copper injurious to health.*

XVII. OF VINEGAR.

The vinegar sold at Paris is still, notwithstanding the surveillance of those who sell it by retail, mixed with foreign substances; this acid which the poor employ as a condiment in the aliments of which they make daily use, is mixed with—1st. Sulphuric acid; and this adulteration is proved every year in Paris. 2nd. With water in the proportion of one-third or one-half; in the latter case the product is not injurious to health, but then the purchaser pays 60 centimes the litre for a liquid which should cost only 30 or 40 centimes. 3rd. With water acidulated by tartaric acid; the buyer in this case is also deceived in the value of the product.

Besides the wine-vinegar sold at Paris, vinegars are manufactured in that capital *with syrup of fecula, with the washing waters of the sugar forms called waters of bac, with wine-leys, and with bacquetures collected under the counters of wine merchants.* None of these vinegars can be compared, as regards taste and acidity, with wine-vinegar. In our opinion, they should be sold only for what they are, and under the names of *vinegars of syrup of fecula, of waters of bac, of wine-leys, and of bacquetures.*

This last vinegar, the vinegar of bacquetures, most frequently contains a salt of lead; sometimes, but rarely, the presence of a salt of copper has been detected.

XVIII. OF TEA.

Tea is adulterated like all other substances; tea of good quality has been mixed with tea which has been used, which has been collected, and which is rolled by suitable means. Teas are colored with indigo and with prussian blue.

In August, 1844, the Administration was informed that a certain quantity of tea derived from an English ship called the Reliance, which had suffered shipwreck on the coast of France, was fished up again, washed with water to free it from the sea salt, then colored green by a mixture of indigo, talc, and chromate of lead, and passed into commerce.

The persons who committed that fraud were a merchant and a working man. At first the correctional police sentenced them to pay a fine of 50 francs, and to be imprisoned for 8 days; but an appeal being made, the merchant was acquitted; the Royal Court, considering that if A. did subject the damaged tea to a treatment to render it saleable, this is no proof of any fraud with reference to the quality of the merchandise sold.

In consequence of this acquittal, the tea, still covered with the chromate of lead, a poisonous salt, which might prove injurious to the animal economy, was restored to Mr. A. It is to be regretted that the Administration did not order that, previous to restoring the tea, it should be washed to remove the chromate of lead.

It is probable that tea colored with the chromate, indigo, and talc, are at present circulating in commerce. It must be remarked here, that this fraud with tea was not only practised in the metropolis, but at the moment when the tea colored by chromate of lead was the subject of an investigation at Paris, M. Merchand, pharmacien in Fécamp, found that tea sold in that town was likewise colored by the same process.*

In addition to this, we could quote a great number of other substances constituting articles of food with which more or less heavy frauds are practised; but we think that the facts above related clearly prove the necessity of a law being enacted with reference to the sale of alimentary substances and spices—a law which would prevent not only the frauds quoted above, but those likewise which I have passed over in silence. This law would have the advantage of protecting the health, as well as the interests, of the citizens.

Before quitting this subject, we deem it proper to inform those who may think that the existing laws are sufficient to prevent delinquencies of the kind, that this is not the case; the Article 318 of the Penal Code says:—"That whoever has sold, or offered for sale, sophisticated beverages, containing mixtures injurious to health, shall be imprisoned for the term of from six days to two years, and fined from 16 to 500 francs;"

* We have seen alcohol containing 30 centigrammes of acetate of copper to one quart of brandy.

* At the same time when the subject was inquired into at Paris, the excise authorities in London seized upon a manufacture of sophisticated tea, one ton of which, having already been used, was worked upon. Shortly previous to that time, a tea merchant of London was sentenced to pay a fine of 200 pounds sterling. This fine did not dishearten the defrauders, which proves that this fraud must be very profitable.

but this article does not extend to such defrauders as mix plaster of Paris with salt; alabaster with fecula; fecula sugar with cane sugar and honey, water with vinegar, &c., &c. For they may plead—1st. That these substances are not injurious to health. 2nd. That they neither sold nor offered for sale the mixed substances found upon their premises. Is it, then, necessary, for the purpose of making application of this law, to have recourse to artifices to prove the sale? We feel indignant at dealings of this kind, both in behalf of the jurisdiction and of the administration. The Article 475 of the Penal Code fines, in the sum of 16 francs, such as have sold *falsified beverages;* in this case as in the preceding one, if the falsified merchandise be seized upon the premises, the defendant will not always forfeit the fine, because he may allege that he did not sell.

The Article 423 runs as follows:—"Whoever imposes upon a purchaser with reference to the standard of articles made of gold or silver; the quality of a spurious stone sold for a fine one; the nature of any merchandise; and whoever, makes use of false weights, &c., shall be sent to prison for the term of from three months to one year, and fined in a sum which may amount to one-fourth of the value."

It would appear that in no case the administration is in a position to prevent the fraud. It is known that a man sold a certain quantity of salt which is injurious to health: some salt similar to that sold is seized upon his premises: has he not a right to maintain that he did not sell this salt? We have witnessed several times cases in which the tribunals acquitted the defaulters, regretting that the law made no provisions empowering them to inflict penalties.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE METHOD OF TESTING BEER.*

BY L. F. STREHLER.

As requisites for a good test of beer, it has been considered necessary that it should comply with the following conditions: never to fail, to be easily executed, practicable, and understood by any individual, even not much versed in chemistry; but such a test will probably remain a desideratum for ever.

In former times the tests employed were merely intended to ascertain one or several physical properties: taste, odor, color, state of clearness, specific gravity, &c. At different periods, persons have been employed by various governments to ascertain, by merely *tasting* the beer, the amount of water contained in it—according to the decision of these individuals, the duty was to be levied. It is proved, however, that taste alone gives no decisive results.

SPECIFIC GRAVITY.

Jacob Faggot, of Stockholm, in the year 1763, employeda arëometers to ascertain the specific gravity which, with some alterations, continue to be used, but the goodness of beer depending upon the amount of alcohol and carbonic acid on the one hand, by which it becomes the lighter the more of them it contains, and upon the amount of sugar, gum, and extract of hops, on the other hand, by which the heavier it becomes, it appears that arëometers can prove nothing with reference to the goodness of beer. The arëometer is, however, of great value as a testing apparatus for wort, in which neither alcohol nor carbonic acid are present, and the amount of extractive substances alone is to be determined.

OPTICAL TEST.

Steinheil in 1841 obtained a patent, for three years, for his contrivance, which is based on the various degrees of refracting light noticed in various liquids. An object is placed against a surface marked with a scale, at a distance of eight feet, and by means of a certain optical apparatus it is observed by how many degrees refraction takes place, and as many degrees as the image deviates from the centre towards the left side so many measures of water are contained in one barrel of beer.* Steinheil states that the results which he obtains are

* Abridged from Schneider's *Annalen der Staatsarzneikunde*, ix Jahrg. 3, 1844.

* For more particulars, *vide Gelehrte Anz. d. K. Ak. d. Wissensch.*, Feb. a, March, 1843.

exact, and that the process may be brought about in a few minutes by any individual.

CHEMICAL TESTS.

Several chemical tests have been proposed by authors, which, however, require much time and skill.

Schrader, for instance, directs us to disengage the carbonic acid by boiling, from a certain quantity of beer, and to collect it over mercury, then to distil from a certain quantity of the same beer its amount of alcohol, and to calculate by the specific gravity of the distilled liquid, by the tables of Lowitz, the quantity of absolute alcohol contained in it; next to evaporate the residue to dryness and to weigh it; to mix it afterwards with water until it becomes of a syrupy consistence, then to add alcohol so long as gummy and mucilaginous substances are thrown down; to pour off the supernatant alcoholic solution of the sugar from the precipitate, and to determine the amount of gum and that of the sugar by repeated evaporation, drying, and weighing. But whoever has had to evaporate gummy or saccharine solutions to dryness, knows how difficult it is to avoid burning. To prevent this from taking place, Lampadius advised to evaporate by steam; but his process, nevertheless, requires much time.

Professor Zenneck, of Tubingen, proposed, in the year 1833, another method, which he called the *pneumatico arëometrical method*, but, even this process, however ingenious, does not perfectly answer. The carbonic acid is to be disengaged and collected in a graduated cylinder over oil, or a saturated solution of salt; the beer, freed from its carbonic acid, is to be examined by the arëometer, the alcohol is then to be distilled off, and, by an addition of water, the beer is to be brought back to its original volume. The density is now again to be ascertained by the arëometer, and the per centage of the extract found in a table prepared by the author; by comparing the results obtained by the two observations instituted with the arëometer, the amount of alcohol is ascertained. The weight is calculated by the volume.

The method of Dr. J. N. Fuchs, Professor in Munich, yields the most certain results, and is easily executed. It is called by the author the *hallymetrical beer-assaying method*, because it is made by salt (ἅλς). Fuchs found that at a temperature of from 32°—90° F. water, invariably may dissolve 36 per cent. of common salt, and that the extractive substances dissolved in the beer, give up the whole amount of their water to the salt, and that finally, the alcohol retains a proportionate quantity of water.

By accurate experiments he determined the amount of water which was retained by the alcohol, and Dr. Steinheil constructed a table by which the amount of absolute alcohol mixed with water may conveniently be found.

To perform a hallymetrical investigation of beer, two experiments are requisite; by the first, the quantity of the free water, and the whole amount of alcohol, extracts and carbonic acid are found; by the second, the amount of the extract is ascertained. The carbonic acid having been expelled by the salt employed in the first experiment, and its quantity determined by the loss, it is merely requisite to substract the quantity of the extract and that of the carbonic acid from the whole amount, and the remainder will give the weight of the spirit of wine contained in the beer, the amount of absolute accohol is then easily ascertained by the table above mentioned.*

ADULTERATIONS.

Bitter substances:—quassia-wood, buck-bean, gentian, wormwood, centaury, &c., are sometimes employed instead of hops, but these, though they render the beer bitter, do not precipitate different substances together with the yeast, which is only accomplished by hops, and without which beer is not durable; hence this fraud is not profitable, and rarely practised, nor is the sophistication with narcotics very frequent [in Germany!] [This is a German prejudice, which does not exist among our English publicans.—Eds.]

To correct the sour taste of beer, several arcana have been recommended by quacks, the active principle of which is chalk, potassa, prepared hartshorn, or magnesia; these palliate only for a few days, and should be prohibited. On evaporating the beer to dryness, and incinerating the residue, these substances are discovered by proper reagents.

Some writers maintain that an addition of water may render the beer poisonous, this our author does not admit.

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* More particulars in the *Kunst und Gewerbeblatt d. Poylt. Vereins f. Bayern*, 1836, pp. 671, 709.

SUMMARY TABLE OF SEVERAL KINDS OF BEER INVESTIGATED BY THE HALLYMETRICAL PROCESS.

No.	Date.	Name of the Beer and Brewery.	Specific Gravity of the Beer, at 60° F.	Contents in 1,000 Parts.					Amount of Contents in 100 parts of Wort.		Price of the Bavarian measure.	One measure weighs Bavarian ounces.
				Water.	Total Amount.	Alcohol.	Extract.	Carbonic Acid.	Water.	Extract of Hops and Malt.		
	1843.	*A. Strong Beer* (Stark										
1	16 June.	Beer) of the Royal Brewery in Munich	1·022	840·84	159·16	88·17	69·19	1·8	85·1	14·9	10 kr.	62·87
		B. Lagerbiere.										
2	1 April.	Widow Dietrich in Donauwerth	1·0105	882·78	117·22	76·89	38·33	2·0	89·3	10·7	8	62·22
3	25 June.	J. Stretzer (Jungbräu)	1·018	876·1	123·9	69·2	53·3	1·4	88·5	11·5	5½	62·64
4	1 July.	Franciscans	1·013	875·39	124·61	76·62	46·49	1·5	88·6	11·4	6	62·13
5	8 July.	T. Kössler (Herrenbräu)	1.014	881·1	118·9	72·3	45·0	1·6	89·1	10·9	6	62·4
6	9 July.	Mozart, in Buchsheim	1·0105	873·06	126·94	80·04	45·2	1·7	88·3	11·7	6	62·35
7	16 July.	P. Horhammer (Quartlbräu)..	1·013	872·78	127·22	96·43	49·19	1·6	88·3	11·7	6	62·11
8	23 July.	L. Walser	1·011	885·0	115·0	73:0	40·5	1·5	89·4	10·6	6	62·22
		C. Schenkbiere.										
9	19 Mar.	Franciscans	1·012	886·1	113·9	72·1	40·2	1·6	89·6	10·4	6	62·24
10	25 Mar.	Mozart, in Buchsheim	1·015	874·44	125·56	75·58	48·08	1·9	88·4	11·6	5	62·43
11	26 Mar.	J. Maier (Schwabenbräu)	1·013	881·67	118·33	74·02	42·51	1·8	88·2	11·8	5	62·33
12	29 Mar.	J. Bonschal (Danielbräu)	1·0164	873·89	126·11	74·91	49·4	1·8	88·4	11·6	5	62·55
		D. Wheat Beer.										
13	5 July.	Kelheim Beer, made of wheat.—(White Beer)....	1·0116	890·28	102·72	71·35	36·47	1·9	90·	10·	6	61·5

Note.—Kr. = Kreutzer of Bavaria. 3 Kr. = 1 penny English. One measure of Bavaria—about 2 pounds 6 ounces English. —nt—

ON COPPER SHEATHING.

BY ARNOLD JAMES COOLEY.

From the experiments of Sir H. Davy, it appears that the loss of copper, from the corrosive action of sea-water, may be prevented, by connecting that metal with zinc, so as to form a galvanic circle. A piece of zinc as large as a pea, was found sufficient to preserve 40 or 50 square inches of copper; and this, wherever it was placed, whether at the top, bottom, or middle of the sheet of copper. When the metallic protector was not less than $\frac{1}{150}$ part of the surface of copper, no corrosion took place, but when it formed only $\frac{1}{200}$ parts and downwards the copper underwent a gradual loss of weight, which was greater in proportion to the decrease of the quantity of zinc, though it was found that even at $\frac{1}{1000}$ a considerable portion of copper was saved (*Phil. Trans.*, 1824). It has been objected to this method of protecting sheathing that unless a certain amount of corrosion takes place, its surface will become foul from the adhesion of shell-fish and marine vegetation. But, as a very small amount of oxychloride of copper (the substance formed by the action of sea-water on copper) will produce this effect, it appears to me that the waste of copper in this way is much greater than is necessary for the mere purpose of keeping the ships' bottom clean. The amount of corrosion might be so regulated, by properly proportioning the zinc, according to some standard, based on actual experiment, that little loss of copper might take place, but yet sufficient to prevent the adhesion of foreign matter. I have data for presuming, that if the zinc formed about $\frac{1}{250}$ to $\frac{1}{300}$ parts of the metallic surface, the copper would be scarcely acted on, and yet sufficiently to promote the object in view. A series of experiments might be instituted for the purpose of deciding the proper proportions the one metal should bear to the other. Those performed in Portsmouth Harbor, at the instigation of Davy, were unsatisfactory; they merely had reference to the protective power of zinc, and not to the greatest amount of this metal that might be adopted without risk of the copper fouling.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

PHARMACEUTICAL PROFANITY.

It must be truly shocking to every well-constituted mind to find the *Pharmaceutical Journal* making use of Scripture in a most profane and indecent manner, for purposes of aggrandisement.

Not satisfied with goading on the members of the Society to the payment of the annual subscription, by holding out hopes of future reward, and in default thereof fears of prospective punishment, the Council of the Pharmaceutical Society, through the medium of their *Journal*, are endeavoring to stifle the complaints of the members, and to counteract their determination to throw off the Society's unprofitable yoke, by likening themselves to inspired beings, and the members to the children of the world of darkness, doomed for their ambition to the servitude of these meek and immaculate creatures.

Should any man doubt our statements, let him refer to the leading article of the *Pharmaceutical Journal* for October last, he will there see a proof of this loathsome and impious abomination—a specimen of fanaticism worthy of the worst days of the Puritans, and the age of religious quackery.

In short, it is really astonishing to us that the members have so long and tamely submitted to be compelled to purchase a journal which allows no freedom of discussion, and which is so totally devoid of scientific information that it could not exist for a day did not the proprietors enjoy the infamous monopoly of supplying the members with it *nolens volens*.

It has often been remarked by the renowned Liebig, that the *Pharmaceutical Journals* of Germany are the privies of chemical science. Gracious heaven! where could he find words to express his feelings of disgust should he ever come in contact with any of the excrementitious matter of the *Pharmaceutical Journal* of Great Britain?

The Council have determined at the eleventh hour to reduce the annual subscription, in the hope of recruiting their much-reduced ranks; and, in consequence, they tell the members they must expect to lose some of their present advantages!! We trust they will not quietly submit to this species of humbug. It must not be forgotten that the Society has realised nearly £10,000,

but for what honest purpose we cannot divine. The members will readily perceive that, by preventing a continuance of this scheme of accumulating the funds, they may more than derive all the same so-called benefits with half the present amount of annual subscription.

We think they have already borne enough under the pretence of benefitting the rising generation without bequeathing them an enormous fortune. It is, therefore, high time that the members should inquire into these things themselves, instead of being led by the nose by the dicta, and frightened by the bugbears of those arrogant and puffed-up ancient ladies—the Council. W. B.

GOWLAND'S LIQUOR.*

The liquid of Gowland is used against prurigo. The receipt books have published methods of preparing it which cannot be brought about. M. Foy gives the following formula by which a liquid is obtained, which remains perfectly white, homogeneous, and may stand at least twelve to fifteen hours without becoming opalescent:—

℞—Emul. of bitter almonds, 200 grammes.
Corrosive sublimate.... 1 ,,
Sal ammoniac ..... 1 ,,

—nt—

PILLS AGAINST VENEREAL CHLOROSIS.†

BY RICORD.

℞—Protiodide of mercury ..... } 3 grammes each.
Extr. lactucæ sativæ }
Thebaic extract.... 1 ,,
Extract of cicuta conii maculati .. 6 ,,
Make 60 pills.

Ricord begins with 1 pill per diem, augmenting the doses gradually, but never administering more than 6 per diem.

In employing these pills, M. Ricord prescribes at the same time a tisane of hops, saponaria leaves, and the pills of Vallet, 9 to 12 to be taken in three doses. —nt—

* *Journal de Pharmacie et de Chimie*, Nov., 1844.
† *Ibid.*

HERBERT'S MECURIAL SOAP.*

℞—Mercury .... } Of each 125 grammes.
Nitric acid.... }

Place these two substances in a matras of 500 grammes capacity, allow it stand at the common temperature, stirring it from time to time until all is dissolved. Take then of washed veal grease 530 grammes fused in a porcelain capsule, in a water-bath, to which, on being retired from the fire, add the mercurial solution, diligently stirring it until the mixture becomes of the consistence of a plaister.

Take then
Of the above pomatum 150 grammes.
Caustic soda of 36° 60 ,,

Triturate these substances with a molette on a marble plate, until the combination is perfect; the soap obtained will be perfectly soluble in water. This soap, says Mr. Herbert, is successfully employed by practioners in cutaneous affections of the face, hands, and arms. The diseased parts are first slightly moistened, and then the soap is two or three times passed over them, or the soap is softened by a little water and applied in the manner of a pomatum. Whenever symptoms of local irritation are noticed, the use of this soap must instantly be suspended.

—nt—

DOCTOR BERENQUIER'S PILLS AGAINST THE INCONTINENCE OF URINE.†

Balsam of copaiva ..... 3 grammes.
Peroxide of iron ..... 6 ,,
Mix exactly, make 100 pills.

The patient takes in the beginning 1 pill previous to each meal; the doses are gradually augmented until 10 per diem are consumed; at the same time tisanes of foliorum nucus juglandis are made use of as the usual beverage.

—nt—

* *Journal de Chimie et de Pharmacie*, Nov. 1844.
† *Ibid.*

IV. REVIEWS AND NOTICES OF BOOKS, &c.

THE USE OF THE BLOWPIPE, IN THE EXAMINATION OF MINERALS, ORES, FURNACE-PRODUCTS, AND OTHER METALLIC COMBINATIONS. By Professor C. Frederick Plattner, translated from the German, with notes, by James Sheridan Muspratt, PhD. With a Preface by Professor Liebig. London: Taylor and Walton.

The publication of the above book will prove a new era in the chemical history of the blowpipe. It is a work comparatively unknown in this country, but which has acquired a great and just celebrity on the Continent, being some time since translated into the French by Dr. Sobrero. Its author, M. Plattner, is assay master at the famous mines at Freyberg, in Saxony, which circumstance, combined with his profound chemical skill, has enabled him to give great attention to blowpipe operations. The result has been the production of a work of unrivalled scientific and practical value, presenting a new and important feature in the use of the blowpipe, viz., its application as a means of *quantitative* chemical analysis.

The thanks of British chemists is especially due to Dr. J. Sheridan Muspratt for having given them this work in an English garb. The translation is quite worthy of the original work. It was a task which required no inconsiderable amount of chemical information, as well as a minute acquaintance with the technical terms used in Germany in mineralogy, mining, and the processes of smelting and assaying. But commendation from us is vain and unnecessary, when we find the translation spoken of in the shape of a preface by the distinguished Liebig in the following highly satisfactory terms:—

"Dr. Sheridan Muspratt's translation of Plattner's excellent treatise upon the use and application of the blowpipe, has been executed with as much fidelity as ability, and I consider that its publication in England will be of essential service.

"This instrument is of the highest advantage to the chemist, geologist, and mineralogist, as a means of ascertaining, with the greatest accuracy, in a few minutes, all the constituents of a mineral.

"M. Plattner's work is the simplest and best adapted for this purpose; as, besides the methods of Gahn, Berzelius, and Gustavus Rose, it embraces the valuable results of his own practical experience.

"The translated edition is further enhanced by Dr. Muspratt's annotations."

We have merely further to add, that great credit is due to the translator, not only for the execution of the work, but also for the liberality he has exhibited by fixing so moderate a price for it as to put it in the power of every person engaged in blowpipe examinations to possess such an invaluable instructor.

"THE GOLD ASSAY.

"Gold can be separated in the dry way, like silver from substances in combination.

"As it is not suceptible of oxidation, even when treated with borax or lead in the outer flame, and sustains no loss in the cupellation, its per centage in ores, minerals, furnace products, &c., may be ascertained with the greatest exactness. The examination for gold, however, is more difficult than for silver, as, in most instances, gold, submitted to blowpipe analyses, contains a quantity of the latter metal, which in native gold varies 2 to 35 per cent.

"Concerning the quantity of gold in several silver ores, I have had occasion to examine all the ores dressed in the Freyberg works, and the results obtained are the following, viz.—That all sulphurets of iron holding from 0·0142 per cent. to 0·456 per cent. of silver, contain gold. This metal forms an ingredient also of the furnace products which are produced in the smelting of auriferous silver ores.

The various auriferous substances are brought, according to their nature and composition, under several heads, viz.:—

"¶ Gold ores, auriferous silver ores, and furnace products containing gold and silver.

"¶ Metallic compounds, consisting of—

"(*a*) Gold and silver.

"(*b*) Gold and silver, alloyed with other metals.

"(*c*) Gold and mercury.

"¶ A *Examination of Gold Ores, Auriferous Silver Ores, and Furnace Products containing Gold and Silver.*—Under this class are ranged:—

"1. Native tellurium, containing, according to Klaproth, 0·25 per cent. gold, but no silver.

"2. All ores and minerals containing silver, and also gold; *e. g.*, graphic tellurium (graphic gold), the composition, according to Klaproth, is 60 tellurium, 30 gold, and 10 silver; yellow tellurium

(Weiss-silvauerz), containing, according to Klaproth, 44·75 tellurium, 26·75 gold, 19·50 lead, 8·50 silver, and 0·50 sulphur; black tellurium, analysis by Klaproth, 32·2 tellurium, 54·0 lead, 9·0 gold, 0·5 silver, 1·3 copper, and 3·0 sulphur; noble molybdena glance, sent me by Professor Breithaupt, I found to contain 4·9 gold, and about 0·3 silver.

"3. All argentiferous sulphurets of iron and copper.

"4. *Roh-* and *Blei-stein.*

"5. The auriferous dross of gold and silver-smiths.

"Of gold ores, containing little or no silver, a quantity sufficient for one examination is prepared, and treated in the same manner as an assay of silver. After cupellation, the color of the globule must be observed, for if only 2 per cent. of silver were present, the gold would acquire a brass color. If the gold be pure, which is known from the color, its weight may be determined either upon the balance or the scale. When its color is very light, it must be submitted to a new treatment, which I shall hereafter describe.

"Of substances containing more silver than gold, a portion of 10 to 15 decigrammes must be reduced to powder, dressed, and treated as in an examination for silver. From the quantity of silver obtained, the number of assays necessary for obtaining a sufficient quantity of gold, to make a quantitative determination, is calculated. Should the substance contain not more than 0·114 per cent. of silver, a considerable quantity of it ought to be pulverised, and at least 2·5 grammes taken; on the contrary, if the per centage be larger, *e. g.*, 0.29 per cent., 10 to 15 decigrammes are sufficient for an examination. The dressing of the assay with lead and borax is effected in exactly the same manner as an argentiferous one, but when copper is present, the proportion of lead must be augmented. The fusion and cupellation can also be achieved in a similar way to the assaying of a silver alloy. I shall refer to the further treatment.

"Sulphurets or minerals containing large quantities of sulphur, and little silver, are analysed in the following way:—24 to 36 decigrammes of the pulverised substance are divided into parcels of three decigrammes each, placed in a clay basin, the inside of which is covered with a coating of reddle, and roasted without addition of charcoal, like a copper assay.

"When nearly all the sulphurous vapor is eliminated, the assay is to be re-powdered, and heated until no appreciable quantity of sulphur remains. This being accomplished, the residuum must be placed in a porcelain basin over a lamp, and treated with a sufficient quantity of hydrochloric acid to dissolve out the formed oxide of iron or copper. The metallic oxides and the silver being dissolved, the gold, with some extraneous matters, will remain. The solution is then to be evaporated to dryness, and treated with boiling water. The soluble chlorides dissolve, and are to be separated from the chloride of silver, &c., by filtration and edulcoration. The filter holding the insoluble ingredients is to be dried, and after desiccation opened and dressed cautiously with five decigrammes of lead and one decigramme of borax. The dressed assay must now be place in a charcoal cavity, submitted to a feeble oxidating flame in order to carbonise and consume the filter, and then treated with a strong reducing flame. In this operation the chloride of silver is decomposed, its base alloying with the lead and gold, the earthly constitutents being dissolved in the borax. The metallic alloy is oxidised and cupellated in the ordinary way, and the auriferous silver globule obtained, treated according to the described method for the separation of gold from silver.

"It sometimes happens that sulphurets containing less than 4 loths (1 loth = 14·58808 grammes = 239·68 English grains), 0·114 per cent. of silver, are to be analysed. In this case, 36 decigrammes are not sufficient, therefore according to the per-centage of the noble metal, the following proportions must be taken, viz.—of a substance containing:—

3 loths	= 0·0939	per ct.	of silver,	48	decigr.
2 ,,	= 0·0616	,,	,,	72	,,
1 ,,	= 0·0370	,,	,,	144	,,
½ ,,	= 0·0142	,,	,,	288	,,

As the weighing of a quantity of nearly 290 decigrammes in portions of 3 decigrammes each, would be very troublesome, it is sufficient to weigh upon an ordinary balance, according to the apothecaries' weight, of an ore containing—

3 loths	of silver	in the cwt.	80	grains;
2	,,	,,	,, 120	,,
1	,,	,,	,, 240	,,
½	,,	,,	,, 480	,,

and to pulverise it well.

"For the same reason, as it would be exceedingly inconvenient to roast a substance in parcels of three decigrammes each, the following expert method may be undertaken:—

"Upon an iron foil, bent into an a basin shape, place the whole assay, besmeared several times with clay-water, and well dried; and submit it to a strong red heat, continually stirring with a platinum spatula until no more sulphurous acid vapors are evolved,

then triturate the residuum in a mortar, and subject the powder to a second roasting.

"The assay, after these operations, must be introduced into a porcelain basin, placed over a spirit lamp, treated with muriatic acid, evaporated to dryness, and then mixed with a quantity of water to dissolve out the soluble chlorides, the menstruum filtered, what remains on the filter edulcorated, desiccated, and if it exceeds one decigramme, weighed in parcels of one decigramme each.

"Each decigramme of this residue is to be dressed with lead, 5 decigrammes, borax, 1 decigramme, fused like an argentiferous assay, and cupellated as already stated. The treatment of the auriferous globule I shall describe in the subsequent paragraphs.

"¶ B METALLIC COMPOUNDS.

"*(a) Examination of such as contain Silver and Gold, only.*—To these belong native gold, alloys of gold and silver, and the argentiferous gold, or auriferous silver, obtained from the assayings of auriferous minerals and ores.

"As, up to the present time, no process is known for separating gold from silver in the dry way, the moist way, termed in this instance 'Quartation,' or 'Refining of Gold and Silver,' must be employed.

"For effecting the separation, the proportion of the gold to the silver should not exceed 1 to 3, as, if more gold be present, the solution will be performed either imperfectly or not at all. It is therefore indispensable to make a preparatory assay for determining the composition of the alloy, and if too small a portion of silver be present, add a quantity sufficient for producing the given standard.

"Gold containing even no more than 2 per cent. of silver, is, as has been previously stated, of a brass color; if 30 per cent. of silver are present, it appears lightly brass-colored, but when the quantity of silver amounts to 60 per cent., a yellow color is no longer perceptible. Therefore, from the intensity of the tinge in an auriferous alloy, conclusions as to its composition, and the necessary quantity of silver, can be drawn.

"When native gold of a brass color is to be assayed, it is generally supposed that the per-centage of silver associated with it is not high; in this case, 20 to 30 milligrammes of the alloy are weighed, fused with ($3 \times 20 = 60$), to ($3 \times 30 = 90$) milligrammes of pure silver (reduced from the chloride of silver), and a small quantity of borax, in the reducing flame. Of a light-colored auriferous body, 50 milligrammes are weighed for examination, and alloyed in the same manner with $50 \times 2 = 100$ milligrammes; or, if the per-centage of silver does not amount to 30 per cent., with 110 to 120 milligrammes of pure silver. In alloys presenting a bright white aspect, and composed of about 40 gold and 60 silver, the per-centage of the latter metal cannot be previously known; therefore 1 decigramme of the alloy should be fused on charcoal, with 60 to 80 milligrammes of pure silver, and a small addition of borax. In compounds of gold and silver obtained from the assaying of minerals or gold ores, gold is generally prevalent, necessitating their fusion with double or triple their weight of pure silver. On the other hand, the composition of alloys produced from roasted ores or sulphurets, are nearly always in the proportion of 25 gold to 75 of silver; therefore, such compounds may be analysed without an extra addition of the latter metal.

"After weighing, according to the quality of the alloy, 20 to 100 milligrammes, and fusing upon charcoal with the necessary quantity of silver, the produced globule must be placed upon an anvil, laminated, re-heated upon charcoal, introduced into a small porcelain vessel, supported over a lamp, treated with pure nitric acid, and covered with a watch-glass to prevent an elimination of nitrous flames. When the solution of silver is complete, the whole must be filtered and affused three or four times with hot distilled water, to remove the last traces of the nitrate of silver. The metallic gold remaining on the filter must be then dried, heated to redness in a platinum crucible, and weighed; but should the quantity be too minute for the balance, it must be alloyed with lead, cupellated, and its weight determined upon the scale. One decigramme of lead will be sufficient for the dressing, and a small quantity of borax. The affining of the auriferous globule is often very difficult, owing to the proportion of lead present, but a little practice will greatly facilitate the assayist in his experiments. For the purpose of rendering the calculations of per-centage of gold in alloys more easy, I annex the following example:—If an alloy of 30 milligrammes has been been assayed, and the product of gold obtained, 25·5 milligrammes, we have—

$30 : 25{\cdot}5 = 100 : x = 85$ per cent. of gold.

If in native gold, or in an artificial alloy, the per-centage of silver is also to be ascertained, the assay must be cupellated (before fusion with fine silver) with 1 to 2 decigrammes of proof lead, to segregate any other metals, such as iron or copper: after affining, weighed; and the per-centage of silver calculated from the difference, provided the quantity of gold has been ascertained.

"*(b) Examination of Metallic Compounds, containing other metals besides*

Gold and Silver.—The most numerous of these are gold, alloyed with copper and silver.

"Of this alloy, 30 to 50 milligrammes are to be weighed, fused according to the per-centage of copper, with 3 to 8 decigrammes of proof lead, and an addition of of borax, upon charcoal, in a good reducing flame; then affined like a cupriferous *workable lead.* The copper oxidizes with the lead, the gold and silver remaining pure. If, however, after cupellation, the gold globule does not appear sufficiently pure, owing to a trace of copper, the bead ought to be immediately re-fused with 1 decigramme of lead, and again affined upon a clear portion of the cupel.

"The other observations agree with those described in the preceding pages.

"*(c) Examination of Metallic Compounds, consisting of Gold and Mercury.*—Although these compounds are not found in nature, they are produced in auriferous amalgamations. To effect their analyses, 50 milligrammes ought to be distilled in a glass tube (like amalgams of silver), and the residue cupellated with 1 decigramme of lead, and the refined globule weighed. If its color be very white, it is a proof of the presence of silver; and, therefore, it must be submitted to 'Quartation,' which has been previously described, and the quantity of gold and silver determined. Of poor amalgams of gold and silver, several samples of 1 decigramme should be introduced into a glass retort, and distilled, and when the mercury is eliminated, new quantities of the amalgam ought to be added, and distilled, until the residue of argentiferous gold is sufficient for weighing. The operation being terminated, the gold globule is to be weighed, and, if necessary, fused with 2 to 3 parts of pure silver; treated with nitric acid; and the weight of the pure gold determined, from which the proportion of silver may be calculated.

"The weight of the gold and silver is to be divided by the number of decigrammes of mercury submitted to distillation, whereby the per-centage of the two metals in 1 decigramme of the assay under examination, is obtained."

TO CORRESPONDENTS.

Several correspondents who have written to us concerning the College of Chemistry, are informed that we must, for the present, forbear expressing any opinion relative to it. When we conceive that we are warranted in doing so, we shall give an impartial judgment. Doubtless our correspondents will understand the necessity and utility of this caution.

Some remarks which we had intended to make on the new Medical Bill, we have postponed for a short time, in the expectation of making them more effectively.

Want of space compels us, reluctantly, to defer answering other correspondents until next month, with the exception of those replied to by post.

SUMMARY OF METEOROLOGICAL OBSERVATIONS MADE AT OTLEY, YORKSHIRE, IN OCTOBER, 1844.

BY E. THOMPSON.

BAROMETER.

Monthly mean	29·50
Mean at 9 a.m.	29·50
,, at 3 p.m.	29·50
,, at 9 p.m.	29·52
Maximum on 26th	30·05
Minimum on 15th	28·81
Range	1·24

THERMOMETER.

Monthly mean	47
Mean of maxima	53
,, minima	41
Maximum on 29th	61
Minimum on 21th	32
Range	29

RAIN.—0·57 inches.

WIND.

	Days.		Days.
N.	1	S.	2
N.E.	1	S. W.	4
E.	1	W.	15
S. E.	0	N. W.	4

WEATHER.

	Days.		Days.
Clear	6	Rain	4
Cloudy	14	Misty	2
Overcast	7	Frost	1
Showers	10	Hoar Frost	1

GENERAL REMARKS.

This month has been dry and mild, and in every respect favorable for agricultural operation. The month has also been healthy, the diseases which have prevailed having been generally of a mild character. A mild form of small-pox has occurred in the neighborhood.

NOTA BENE.—*All Communications, Books for Review, and Substances to be Analysed, must be addressed "To the Editors of the Chemist, 310, Strand, London." Communications must be prepaid, and sent before the 15th of each month; Books for Review before the 10th.*

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